

# ANNALS of SURGERY

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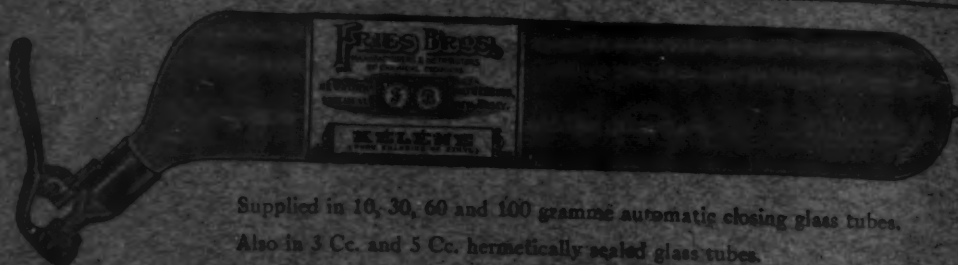
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# ANNALS *of* SURGERY

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## SOME SURGICAL ASPECTS OF THE PATHOLOGY OF GLIOMAS OF THE BRAIN \*

BY ERNEST SACHS, M.D.

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FROM THE NEUROSURGICAL SERVICE OF WASHINGTON UNIVERSITY SCHOOL OF MEDICINE

BEFORE any surgical society, a discussion of the pathology of any group of tumors is only of interest if it is correlated in some way with the surgical problems concerned. In dealing with the pathology of gliomas, it seems to me of especial interest to consider the regions of brain in which these tumors occur and what bearing, if any, the location of the tumor has on its pathology or operability. The first question is, does a certain type of glioma occur in a certain region of the brain, or may the various types develop in any portion of the brain? Secondly, can we tell by the gross appearance what histological type of glioma we



FIG. 1.—Glioma composed of glia nuclei which has a sharp border and can be fairly easily enucleated.

\* Read before the Southern Surgical Association, December 9, 1924.

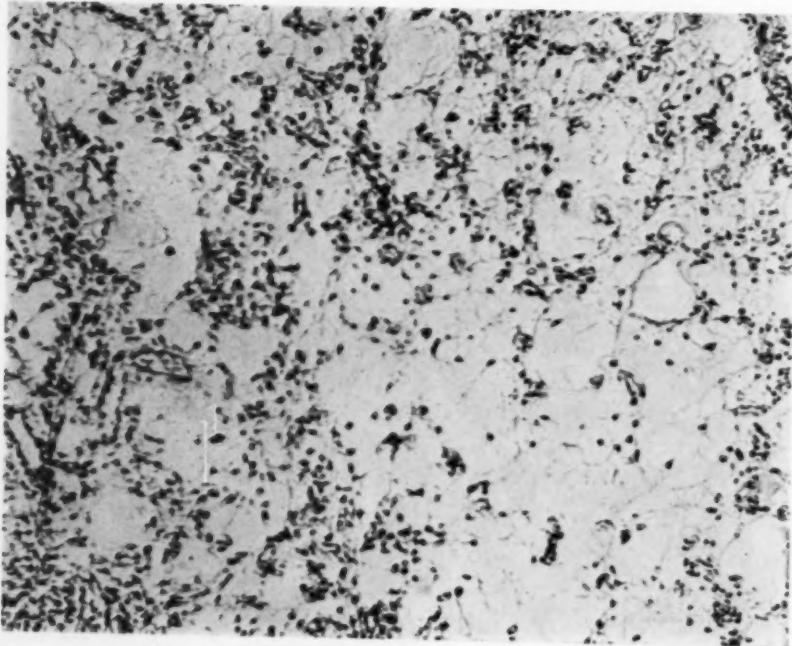


FIG. 2.—Glioma composed of much reticulum, very soft gelatinous tumors. The type that occurs in the cerebellum.

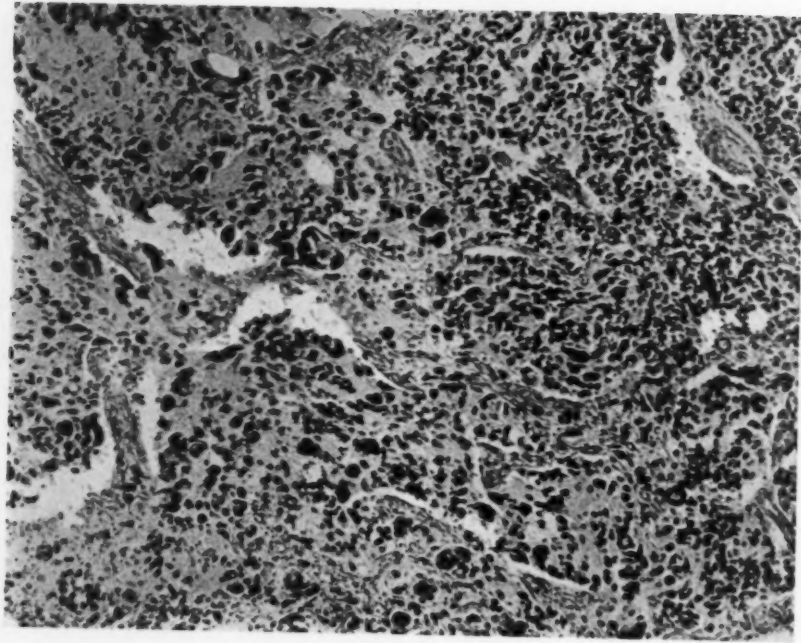


FIG. 3.—Glioma composed of cells varying greatly in size. Infiltrating type grows very rapidly.

## GLIOMAS OF THE BRAIN



FIG. 4.—Glioma composed of nuclei with well defined border, could be readily shelled out.



FIG. 5.—Glioma composed of glia nuclei, occurring in the cerebellar cortex. Tumor had well defined border and could be readily enucleated.

are dealing with? Our first problem, therefore, is to consider how we may classify our gliomas pathologically.

I have examined our sections of between sixty and seventy gliomas in order to throw light on these points. We have been handicapped by our methods of preservation. Practically all our tissue has been preserved in formalin. Tissue preserved in this way cannot be stained by the newest stains that have been devised by del Rio Hortiga, a pupil of Cajal. These methods have only recently been made accessible to us by the publication of Bailey,<sup>1</sup>



FIG. 6.—A. P. had a gliomatous cyst removed ten years ago. Solid portion of glioma lay in the wall of cyst. Histologically composed of glia nuclei as are the encapsulated solid gliomas.

and it may be that they will modify our ideas in regard to gliomas. We have thus far only been able to study a few tumors by this method, and our experience is entirely too limited to warrant an expression of opinion based on those stains. This, however, is the line that must be followed in the future, and I shall show you on the screen what extraordinary pictures one gets by these methods.

For the present paper, I have studied examples of the three clinical types of gliomas to see whether the pathological picture of one type is always the same, or whether certain types develop only in certain regions. The three clinical types of gliomas that I recognize are gliomatous cysts, which are cysts containing yellow fluid, which coagulates readily, and having in their wall the growing glioma; secondly, the well defined, fairly well circumscribed glioma, which is a solid tumor that can be quite readily shelled out, and might very



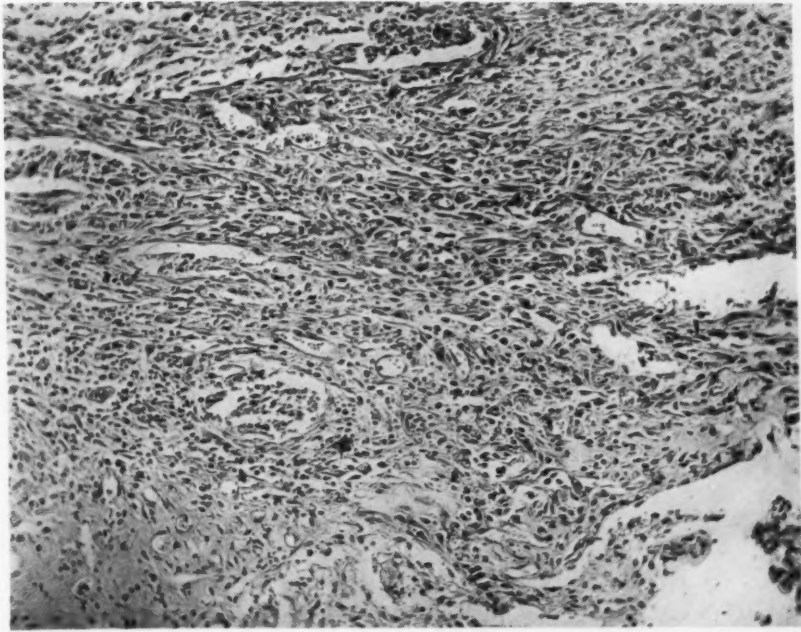


FIG. 7.—Infiltrating type of glioma.

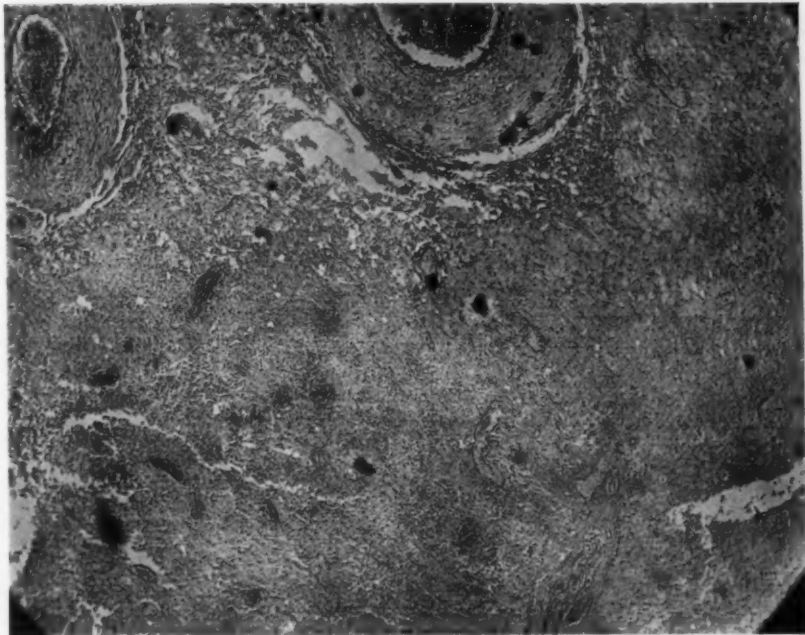


FIG. 8.—Same tumor as Fig. 7 after intensive X-ray therapy. There is extensive necrosis with marked thickening of the vessel walls not unlike the vessel changes in syphilis. These changes in the vessels not seen before X-ray was instituted.



FIG. 9.—Fibrous neuroglia in the cortex of a dog. Stained by silver stain of del Rio Hortiga.

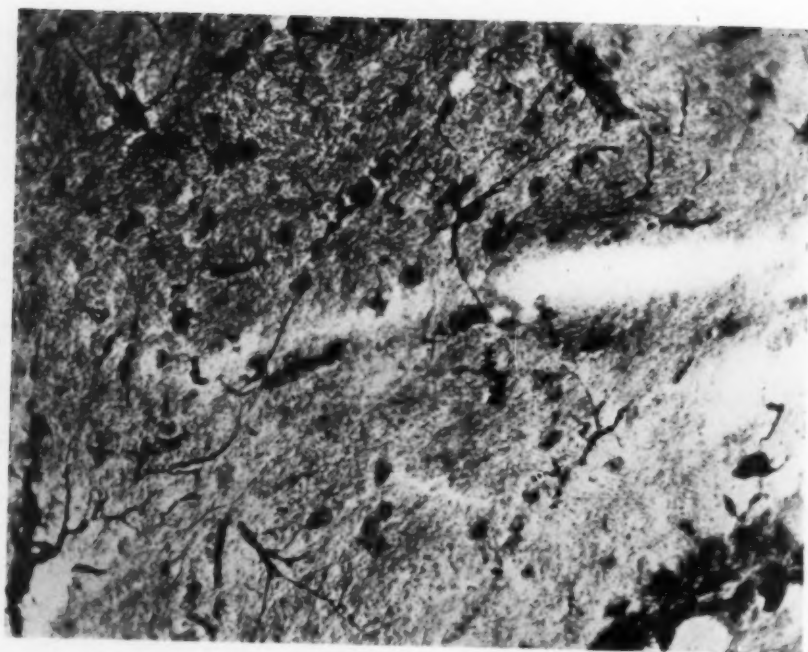


FIG. 10.—Microglia and oligodendroglia in cortex of rabbit.

## GLIOMAS OF THE BRAIN

properly be called a benign glioma; and lastly, the infiltrating glioma whose border imperceptibly shades off into normal brain tissue.

For some years, in teaching surgical pathology, I have differentiated three kinds of gliomas: First, those composed primarily of glia reticulum. Secondly, those in which the glia nuclei predominate, and these are the tumors that have been called by some gliosarcoma, but I believe with proper staining methods one can always demonstrate that they have glia reticulum, and consequently should properly be classed as gliomas. Thirdly, those with cells of varying size often containing numerous giant cells and usually showing evidence of rapid growth. This classification is similar to that of Tooth.<sup>2</sup>

In going over our tumors, I have been surprised to find that the gliomatous cysts and the gliomas with well defined borders all seem to have the histological picture in which glia nuclei predominate, while the infiltrating gliomas have a large variety of histological pictures. Some of these tumors are composed of reticulum with few cells and grossly appear where there are very few cells, white and gelatinous. Others contain many cells of varying size and also contain many giant cells.

The gelatinous type, which is almost translucent in appearance, I have only seen in the subcortical regions of the cerebellum. The other types, with cells of varying size, I have seen in every portion of the cerebrum, particularly in the basal ganglia. If these observations about the occurrence of different types of gliomas are correct, our problem narrows itself to the application of this information in the treatment of glioma cases.

I believe we are justified in drawing these conclusions:

All gliomas that are cystic in character or, if solid, have a sharp line of



FIG. 11.—Brain tissue at the edge of a glioma showing tremendous number of fibrous neuroglia. The tumor itself, however, contained no cells of this character. There is some question whether these cells are found in the tumor itself.

demarcation, are composed of glia nuclei, are favorable cases for radical removal, and these cases, especially the cystic variety, offer a very good prognosis. Those that are deep seated in the cerebellum are less favorable, but are so soft that, with suitable suction apparatus, they can probably be quite completely removed by that method, but they show a great tendency to recur. I have hoped that by the proper application of the suction method some of these solid tumors might be transformed into cysts, so that at a subsequent operation one might have a cyst to deal with, which would simplify the problem. As yet I have not had an opportunity in which to determine whether this can be done. Deep seated tumors in the cerebrum are infiltrating tumors, and are unfavorable cases to deal with. One never knows if one has removed them in toto, for the transition from normal to abnormal tissue is often imperceptible. These are the rapidly growing tumors and have a bad prognosis. There are some gliomas that seem to respond to deep X-ray therapy. I have a very few such cases under observation, but I do not know whether the cases that respond to X-ray all belong to one of these histological groups or to different ones.

Whether this method of studying gliomas will prove useful, time alone can tell. It may be that the employment of these new staining methods will give us a sounder basis of classification. The principle, however, remains the same, to try to correlate our histological findings with the clinical pictures and thus establish sounder bases for treatment than we have had in the past.

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# MANAGEMENT OF INTRACRANIAL INJURIES WITH OR WITHOUT FRACTURE\*

By JOHN FOX CONNORS, M.D.

OF NEW YORK, N.Y.

FROM THE SURGICAL SERVICE OF THE HARLEM HOSPITAL

BETWEEN the years 1914 and 1924 inclusive more than eleven hundred patients with a diagnosis of possible fracture of the skull were admitted to the surgical service of Harlem Hospital. Of this number the diagnosis was absolutely established in 497 cases. Based upon the operative interference these cases have been divided into two periods: 1. From 1914-1917, termed the operative period. 2. From 1918-1924 termed the conservative period.

TABLE I

## *Intracranial Injuries Received at Harlem Hospital*

	1914-1917	1918-1924	Total
Number of cases .....	218	279	497
Deaths in 48 hrs. ....	92	89	181
Deaths later than 48 hrs. ....	31	46	77
Deaths without operation .....	109	123	232
Deaths following operation .....	14	12	26
Recoveries without operation .....	68	130	198
Recoveries following operation .....	27	14	41
Total operations .....	41,18.7%	26,9.3%	67

From the above table it will be observed that in the first three years 18.7 per cent. of the cases were operated upon as compared to 9.3 per cent. in the last seven years. Again, contrast 130 cases which recovered without operation with sixty-eight cases in the first period. This large number of recoveries without operation is a good indication for conservatism in the treatment of fractured skulls in general.

Intracranial injuries have been classified as follows: A. Without fracture:

1. Concussion of brain. 2. Contusion of brain. 3. Laceration of brain.
- B. With fracture: 1. Concussion of brain. 2. Contusion of brain.
3. Laceration. a. Laceration of meningeal artery. b. Contre-coup laceration of brain. c. Depressed fracture with laceration of brain.

A. *Without Fracture*: 1. Concussion without fracture is very common and the cases usually recover. The recent observations of one of us (C. S. B. C.),<sup>1</sup> are enlightening. With a fall or blow there is a change in the shape of the skull. This change in shape is one in the direction of flattening and diminution of the space for the cerebrospinal fluid. The fluid is driven through the various sulci of the brain and into the perivascular lymph spaces where it ruptures the fine fibrillar attachments of the blood-vessels to the brain which traverse the perivascular lymph spaces thus causing a laceration of

\* Read before the New York Surgical Society, January 28, 1925.

the blood-vessel. At autopsy there may be no visible pathology, gross or microscopic. On the other hand multiple punctate hemorrhages may be present. Of the five cases autopsied three were operated upon with a diagnosis of epidural hemorrhage, the other two cerebral edema. All five cases had a history of brain injury without laceration of the scalp. The spinal tap is clear. There is no brain swelling or pressure. Although the hemorrhages may be numerous their aggregate forms a very small blood clot or compressing substance.

2. Contusion is less frequent than concussion. These cases usually recover. As in concussion, the treatment should be palliative.

3. Brain laceration without fracture has not been observed in this series of cases.

*B. With Fracture:* 1. There are various degrees of concussion associated with all fractures of the skull.

2. Contusion of the brain consists of small hemorrhages in the pia-arachnoid meshwork. The bleeding is usually very slight therefore, producing very little compressing substance. In these cases a bloody tap is found, but not to the extent that is present in brain laceration. The treatment is palliative because rarely is there enough hemorrhage to cause compression.

3. Laceration: a. Laceration of the meningeal artery: The middle meningeal artery has numerous branches. Since most blows or falls are on the posterior half of the skull the posterior branch is the one which is most commonly lacerated. The vessel is lacerated where the fracture line crosses it. The condition is ushered in by concussion. This is followed by a lucid interval which varies from hours to days. The factors determining the length of this interval are as follows. The size of the vessel lacerated, the extent of the laceration and the adherence of the dura to the skull. Headache, vomiting and drowsiness which lapses into unconsciousness are usually present. Associated with these symptoms is a progressive paralysis which never reaches the flaccid state. A gradual rise in blood-pressure follows. The spinal tap is clear. A dilated pupil always occurs on the side of the hemorrhage.

*Treatment.*—As soon as the diagnosis is established operation is indicated. The operation should be planned according to the position and direction of the fracture. If one fails to find the clot beneath a fracture communicating with a suture, the suture line should be considered as part of the fracture where the clot will be found. In three instances the operator failed to do this, and later at autopsy the clot was revealed beneath the suture line. It also should be borne in mind that more than one branch may be torn. After the clot is found it is removed and the bleeding points controlled by suture. Controlling the bleeding by packing should be condemned because the same degree of compression may be produced as existed before operation.

b. Contre-coup laceration of the brain occurs on the opposite side to which the force is applied. The explanation of the mechanism is a matter of conjecture. Focal neurological symptoms are frequently absent as the patient is unconscious. The laceration usually involves silent areas. The spinal tap

is always bloody since the lacerations are cortical and contaminate the cerebrospinal fluid. A careful study of the eye grounds for papillitis and choked disk in a large series of these cases by Dr. Martin Cohen<sup>2</sup> was of no definite diagnostic value as an indication for or against operation. In none of these cases was a choked disk observed. The time for surgical interference could not be definitely decided upon by the use of the spinal manometer.

Before discussing the treatment of contre-coup laceration of the brain a word may be said about cerebral oedema. If it exists the indication for operation is not clear. Based upon the autopsy findings in more than one thousand cases of head injuries by one of us (C. S. B. C.) its existence as a pathological surgical entity is yet to be demonstrated. Oedema of the brain should produce brain swelling, which in turn should cause flattening of the convolutions and narrowing of the sulci. This flattening in cases of trauma to the brain was never found except where a large blood clot or other substances (bone, etc.), or infection were present. In many cases during operation there is an escape of cerebrospinal fluid after the arachnoid is cut. This has been referred to as oedema of the brain by many surgeons. In reality these brains are the dryest because the fluid is in the pia-arachnoid meshwork.

In cases of lacerated brain far greater damage is done by the existing hemorrhage than by the laceration itself, as is exemplified in the following case report (J. F. C.):

On April 6, 1908, N. B., an eight year old boy was admitted to Harlem Hospital. One hour previous to admission he was struck by a large pulley block which had fallen twenty-five feet, crushing and bruising the entire left side of the head producing a compound comminuted fracture through which blood, cerebrospinal fluid and brain tissue were oozing. He was unconscious and a flaccid paralysis of his entire right side existed. The wound was explored without anaesthesia. A large amount of pulpified brain tissue was removed. There was very little bleeding. In forty-eight hours the child regained consciousness and within three weeks he was able to talk. Eight weeks later the child left the hospital having completely recovered from the paralysis. The patient remained well for nine years. He made progress in school and was considered a very intelligent boy by his teachers and family. At this time he developed attacks of epilepsy which in the beginning occurred once a year, gradually becoming more frequent until 1921 when he was operated upon and died. The description of the operation was not obtainable from the surgeon who performed it. A communication from his mother expressed it as a "pressure on the brain." Following this operation she said that his entire right side again became paralyzed and he lost his power of speech.

*Treatment.*—The indications for surgical interference and the selection of the site for operation are difficult to decide, since the slowing of the pulse, progressive elevation of the blood-pressure, focal and neurological symptoms are the same in cases which recover or end fatally. In no instance was an operation performed. Considering the number of patients that die within the first forty-eight hours as indicated in Table I, it would seem that this is the time for surgical interference. The consensus of opinion is that these cases should always be allowed to react from shock. In our cases subnormal temperature, rapid pulse, cold and clammy skin have rarely been the existing conditions on admission.

The routine subtemporal decompression operation often fails for the reason that it does not expose the lacerated brain, remove the compressing substance or control the source of the compressing substance which is the bleeding brain. In many instances where the operation is performed, the brain itself, if there be a compressing substance at a distance will herniate through the opening, thus producing further damage with a possibility of renewed bleeding. If an operation is to be performed it should expose the lacerated brain, the blood clot should be removed and the hemorrhage resulting from the laceration controlled by other means than by packing. At present we are doing some experimental work attempting to control hemorrhage of brain tissue and hope to make a report at a later date. Until an operation can be devised that will meet the requirements as described above, conservatism is recommended in these cases of contre-coup laceration of the brain.

The use of repeated spinal taps for the treatment of increased intracranial pressure has not proved of value, and has many objections, namely:

1. Cerebrospinal fluid quickly reaccumulates.
2. It encourages secondary hemorrhage.
3. It fails to remove the blood which lies between the dura and the arachnoid.
4. It may cause medullary pressure by the brain descending into the foramen magnum.
5. Danger of infection.

For the past two years a saturated solution of magnesium sulphate has been used in these cases of brain injury. The value of this treatment up to the present time has not been established.

c. Laceration of brain, result of depressed fractures: Simple depressed fractures of the skull should not be operated upon promiscuously. An operative incision through a swollen and traumatized area often fails to heal by primary union. Furthermore, a depressed fracture is converted into a compound fracture and by manipulation and elevation of the fragment a secondary hemorrhage may occur. In compound depressed fractures it is our custom to do a "débridement" or cleansing after the method of Cushing. If fragments of bone are pressing upon or are driven into the brain they are elevated. These fragments of bone are allowed to remain *in situ*, and when they unite form a firm bony covering for the involved area. Perforations of the dura are closed by suture. As a rule these cases are not drained, but should drainage be employed it should be in the form of strands of silkworm gut or small pieces of rubber tissue. In both types of cases, if lacerated brain is present, it offers the same problem as contre-coup laceration.

The management of intracranial injuries at Harlem Hospital is as follows: The patient is admitted with a tentative diagnosis of intracranial injury. The head of the bed is elevated. An ice cap is applied. Pulse, respiration and blood-pressure are frequently taken and recorded. A solution of 3½ per cent. iodine is applied to the nose and the ears. A 10 per cent. solution of argyrol is dropped on the conjunctiva. Six ounces of a 50 per cent. solution



## MANAGEMENT OF INTRACRANIAL INJURIES

of magnesium sulphate in the form of a retention enema is given every six hours. A spinal tap (three-tube method) is performed. Mouth hygiene is rigidly carried out. The position of the patient is changed frequently. If paralysis is present its progression is carefully noted. These patients are examined by the neurologist, who reports the advisability for or against operation. In children and men the scalp is shaved and the exact location of hæmatomas is noted. This is very important if operation is decided upon, as the hæmatoma is used as a guide for the location of the incision in contre-coup laceration. Nourishment is sustained by the use of rectal feedings.

### CONCLUSIONS

1. No case of intracranial injury should be operated upon until definite localization of the brain injury has been determined.
2. If an operation is to be performed it should expose the brain laceration, remove the compressing substance and control hemorrhage.
3. The subtemporal decompression operation as a routine measure fails in the majority of cases because it does not expose the lacerated brain, remove the compressing substance or check the hemorrhage.
4. In view of the fact that such an operation has not yet been demonstrated, palliative treatment is recommended in cases of contre-coup laceration of the brain.

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## SPLENIC BLOOD DISORDERS

A SURGICAL CLASSIFICATION WITH REFERENCE TO SPLENECTOMY

BY EDWARD M. HANRAHAN, JR., M.D.

OF BALTIMORE, MD.

THE modern conception of splenectomy as a therapeutic procedure may be said to have begun with Spencer Wells in 1866. While it is true that this operation had been performed not infrequently before that time, both experimentally and clinically, there were many doubts as to its justifiability. Two unsuccessful attempts at deliberately planned splenectomies, reported by other observers, led Simon in 1857 to state that the operation was justifiable only when necessitated by an otherwise fatal wound. His influence was considerable, as splenectomy was not again reported until 1866. Two years later sixteen cases were reported, and since that time the literature on the spleen has become enormous.<sup>1</sup>

Our interest to-day is the application of splenectomy to those various and little understood forms of blood disorder characterized by more or less splenomegaly, anæmia or polycythæmia, with or without jaundice. Were our knowledge of the exact mechanism of the hæmolytopoietic system complete, the problem would be much simpler. There is normally present a definite amount of blood destruction which is balanced by an equal amount of blood formation. We have information regarding this mechanism of blood-balance from two main sources. The evidence of blood destruction is the excretion of urobilin in the stool and urine, while that of blood formation is seen in an examination of the blood itself and of the bone-marrow. Eppinger,<sup>2</sup> from estimations of the total urobilin excretion, and estimating the amount of hæmoglobin represented, concluded that one thirty-sixth of the total blood was daily destroyed and replaced. A disturbance of one or both of these factors will produce the symptoms which may be recognized as anæmia or as polycythæmia.

By reason of its enlargement in these pathological conditions, the spleen has long been thought to play an important part in their production, and splenectomy was early employed on this purely empirical basis. The spleen undoubtedly does play a part in the hæmolytopoietic system, but its function is not known. It apparently is a factor in embryonic blood formation, and appears to have in adult life an important but not indispensable part in blood destruction. The anatomical position of the spleen is significant. It is so placed in the portal system that most of its venous blood is carried directly to the liver, of which one function is the formation, or at least the excretion, of bile. The chemical composition of bile may be traced to hæmoglobin on the one hand, and to urobilin on the other. These facts suggest that a derangement of this function of the spleen may be related to the production

## SPLENIC BLOOD DISORDERS

of several forms of blood disorders, particularly those in which there is a marked splenomegaly, and in which the amount of urobilin excreted is affected. That this is not the only factor, may be readily noted by the variability of results seen following its removal.

Because of the lack of knowledge regarding the actual function of the spleen in relation to blood metabolism, any surgical classification of splenic disorders based on etiology is impossible. We are therefore justified in turning to the study of end-results for information regarding the value of splenectomy. Here again we are confronted by a serious difficulty. While the diagnosis of the typical conditions exemplified by pernicious anemia, hæmolytic jaundice, splenic anemia and aleukæmic leukæmia may often be clear, there are many cases in which a differential diagnosis may be impossible. It is the presence of such cases in any series that lessens the value of conclusions drawn from end-results. These studies, however, appear to be our most reliable means of estimating the true value of splenectomy, and on this basis, we may attempt a surgical classification of blood disorders in which splenectomy has been advised.

The first group of this classification will include those conditions in which splenectomy seems definitely indicated, both by reason of its successful end-results, and because of its known effect on at least one underlying cause. Purpura hemorrhagica, or essential thrombocytopenia has been shown by Kaznelson<sup>3,4</sup> to be a disorder of this type. Following splenectomy in this condition, the blood platelets are markedly increased, sometimes to normal, a feature which accompanies the complete disappearance of symptoms. Another disorder which seems to belong here is the slow chronic form of familial hæmolytic jaundice. After splenectomy there may be seen a definite effect on the osmotic resistance of the red blood-cells to hypotonic salt solution. This decrease in fragility does not always occur, and does not always give an accurate index of the true value of splenectomy in this condition. The early forms of that disorder known as splenic anemia, which includes the early first stage of Banti's disease, also belongs in the first group. In splenic anemia, emphasis is placed on the necessity of early, rather than late, removal of the spleen. The beneficial effect seems due to the elimination of that fibrotic organ which is responsible for the formation of varices of the collateral venous circulation, the rupture and bleeding of which is responsible for the marked secondary anemia, occurring in the later stages of the condition. Early removal of the spleen also seems to prevent the development of the liver cirrhoses, which characterize the so-called third stage of Banti's disease. Another important argument for early operation is the fact that the procedure is much easier, and the operative mortality correspondingly lower. The hypothesis that the spleen may produce a hormone acting as a depressant on the bone-marrow, the loss of which is responsible for the marked leucocytosis seen immediately following splenectomy, has not been wholly accepted, although it is very attractive. It should be stated, however,

that the slowly developing forms of splenic anæmia are not always ultimately fatal, and that a comparison of followed cases shows many, not operated upon, living for lengths of time quite similar to those operated on.

The second group is made up of borderline disorders. It includes those conditions in which splenectomy may result in a clinical cure. By a clinical cure is meant an improvement in symptoms and prolongation of life, with no demonstrable effect on any known underlying cause. We perhaps remove the organ through which the disease is best able to act, or upon which the effect of the disease is most marked. The disorders to be included here are the more progressive forms of hæmolytic jaundice and splenic anæmia. The occasional results seen in some cases of pernicious anæmia would suggest that this disorder be included here. But the poorest results observed following splenectomy in the first two of the above conditions, occur in those cases in which there is a question of pernicious anæmia, and although Dr. W. J. Mayo<sup>5, 6</sup> reports that in fifty-three cases, twenty-two per cent. lived two and one-half times as long as the average, my comparison<sup>7</sup> of ten operated cases with ten unoperated, shows that the average duration of life may be only slightly affected by splenectomy. However, Doctor Mayo found sixteen of his fifty-three cases living after four years, and this would definitely indicate that there are some cases of pernicious anæmia distinctly benefited. The result may often be foretold by the effect of splenectomy on the urobilin excretion.

In the third group are those disorders in which splenectomy has little or no effect, or in which the operation often causes a rapid termination of the process. These conditions include lymphoid and myeloid leukæmia, polycythæmia, and the acute fulminant forms of hæmolytic jaundice and pernicious anæmia.

It is rather a paradox that splenectomy has been advocated in such apparently contrasting disorders as pernicious anæmia and polycythæmia. On the basis of urobilin studies in the former, Eppinger felt that the demonstrated increased blood destruction was due to hypersplenism, and advocated splenectomy because of its effect in lessening the urobilin excretion. This would constitute an excellent theoretical indication for splenectomy, and would need only satisfactorily proven effects in actually prolonging life, definitely to place this disorder in group two of this classification.

Following the removal of a ruptured normal spleen, or the slightly damaged spleen of an early splenic anæmia, a marked increase of red blood-cells, sometimes to over six million, has often been noted. In spite of this, splenectomy has been advocated in polycythæmia. Here again we must depend on end-results, particularly as the theoretical evidence is so unsatisfactory. One of the most recent reports is that of Sauer,<sup>8</sup> who performed splenectomy in a patient having 6,500,000 red blood-cells, and 90 per cent. hæmoglobin. After three weeks the red cells had increased to 12,000,000, and death followed thrombosis of the portal vein.

Until recently, splenomyelogenous leukæmia has been considered a dis-



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order in which splenectomy is contra-indicated. Dr. W. J. Mayo has noted an improvement in results when the operation is preceded by radiation of the enlarged spleen. It will be interesting to learn how long a duration of life we may expect with this procedure, as contrasted with the results following radiation only, and contrasted with the natural history of the disorder.

The idea has been advanced that any enlarged spleen is a diseased spleen, and as such should be removed. But I think that this conception should be modified both on theoretical and clinical grounds. We know that the spleen is not necessary for life, and therefore that any question of hypofunction is doubtful. This leaves only three bases for splenic enlargement. First, the normal spleen enlarged by reason of circulatory disturbance, or fibrosis. Second, the enlargement apparently the result of normal function upon abnormal blood. Third, the enlargement of hyperfunction. Splenectomy should be performed in the first, when the benign enlargement causes circulatory or other disturbances, such as hæmatemesis; in the second and third, when the end-results seen in similar cases have proven it helpful.

It is essential, lest this valuable operation fall into discredit, that it be reserved for those conditions in which it is beneficial, or at least not actually harmful. I feel that it is indicated in those conditions in which the end-results seen in similar cases have proved its value, or in which this beneficial effect outweighs the operative mortality, which is at least 10 per cent., and is usually higher.

### CONCLUSIONS

1. The spleen undoubtedly plays an important part in the hæmolytopoietic system, but its action and function are entirely unknown. Because of this, the indications for splenectomy are poorly defined.

2. Since it is impossible to make an etiological classification of those blood disorders characterized by more or less splenomegaly, anæmia or polycythæmia, with or without jaundice, a surgical classification based on end-results is attempted.

3. These disorders may be classified surgically into three groups:

*Group 1.*—Splenectomy is definitely indicated in purpura hemorrhagica, the slow chronic forms of familial hæmolytic jaundice, and the early forms of splenic anæmia (including the Banti syndrome).

*Group 2.*—Splenectomy should be considered, and the decision based on the results seen in similar conditions, in the more progressive forms of hæmolytic jaundice, particularly the acquired forms, splenic anæmia, and in rare cases of pernicious anæmia. When such cases of hæmolytic jaundice or splenic anæmia show suggestive signs of pernicious anæmia, the results are usually unsatisfactory.

*Group 3.*—Splenectomy is contra-indicated in lymphoid and, unless previously radiated, myeloid leukæmia, polycythæmia, and the rapidly progressive fulminant forms of hæmolytic jaundice, splenic anæmia and pernicious anæmia.

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## DRAINAGE OF THE THORACIC DUCT IN EXPERIMENTAL PERITONITIS<sup>1</sup>

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IN THE past two years there has appeared in the literature a number of articles, experimental and clinical, which would seem to give promise of spectacular results to be obtained by draining the thoracic duct in cases of peritonitis.

The thoracic duct is made up histologically of three coats, an internal or endothelial, a middle or muscular and an external or connective-tissue coat. It originates at the second lumbar vertebra, the receptaculum chyli and extends to the junction of the internal jugular and left subclavian vein, where it terminates. At the mouth of the duct in the wall of the vein there are two valves which prevent the flow of blood back into the lymph channel. The thoracic duct conveys the finished product of digestion, the chyle, into the blood current and also collects the lymph from the entire body, with the exception of the right upper half. The current of the chyle is controlled by the movements of respiration. With each respiration there occurs a temporary negative pressure within the thorax which draws the chyle from the abdominal cavity. Many anomalies occur, the most common of which are, its location on the right side, its entrance into the jugular vein and the existence of multiple ducts which may empty in several different places.

The first instance of therapeutic drainage of the thoracic duct was performed by Wilms in 1910 for fat embolism, and resulted in recovery.<sup>2</sup> In November, 1922, Dr. W. A. Costain<sup>3</sup> of the University of Toronto, reported the results of his experiments on the drainage of the thoracic duct in diffuse septic peritonitis in animals. He ligated the base of the cæcum, or as we shall designate it, the appendix, to determine the lethal standard. He found that in a series of seven dogs in which the appendix and meso-appendix were ligated, all died within forty-eight hours. Hence this method was adopted as a lethal standard of comparison. In a second series of experiments consisting of eleven dogs, the appendix and meso-appendix were ligated to produce a peritonitis and at the same time the thoracic duct was ligated. Four dogs recovered, and it was noticed that in each case of recovery, a thoracic duct fistula had developed. Therefore a third series of seven dogs were subjected to ligation of the appendix and drainage of the thoracic duct, twenty-four hours later. In this series three dogs recovered, having drained successfully,

<sup>1</sup> Read before the Chicago Surgical Society, January 2, 1925.

<sup>2</sup> Wilms: *Semaine Med.*, March 23, 1910.

<sup>3</sup> Canadian Med. Assn. Journal, Nov., 1922.

three died from a "collateral flow of lymph" and one died of pneumonia. Doctor Costain concluded that drainage of the thoracic duct would be a valuable aid in the treatment of a generalized peritonitis. He concluded that toxic absorption occurred mainly by way of the thoracic duct. In March, 1923, he reported <sup>4</sup> the successful result of a lymphaticostomy in a case of pneumococcic peritonitis in a child of nine years. In February, 1924, Dr. A. C. Edwards <sup>5</sup> of Baraboo, Wisconsin, reported the successful treatment by lymphaticostomy of a severe case of puerperal sepsis, Costain <sup>6</sup> again quite recently drained the thoracic duct in a boy of eleven years suffering from a generalized peritonitis with a successful result. Dr. A. Cooke of England has reported a case of diffuse peritonitis following a ruptured appendix, with recovery following a lymphaticostomy. In this case the abdomen was closed after the appendix was removed.<sup>7</sup> Recognizing the possibilities of lymphaticostomy as a possible life saving procedure, we were prompted to undertake the following experimental work in an effort to determine the value of this operation. The work was first suggested by Dr. Leroy H. Sloan and carried out by Dr. Lewis Bell and myself in the experimental laboratories of the Northwestern University. We decided first to find a lethal standard. Series I, therefore, consisted of thirteen dogs, in which the appendix and meso-appendix were ligated. Two dogs died in twenty-four hours with beginning peritonitis. The appendix was necrotic but not perforated. One dog died in forty hours with advanced peritonitis, having gangrene and sloughing of the appendix with perforation. Six dogs lived forty-eight hours with post-mortem showing advanced peritonitis and sloughing and perforation of the appendix. Three dogs lived four and one-half days to five and one-half days, and on post-mortem revealed advanced peritonitis. One dog lived thirteen and one-half days. Post-mortem showed that the appendix had sloughed off and the peritonitis had subsided. This dog died of intestinal obstruction.

Summarizing: Nine dogs died within forty-eight hours, and four dogs lived from four and one-half to thirteen days. It appears quite evident that in a series of this sort a certain number of animals were able to develop immunity sufficient to keep them alive for a period greater than the lethal one established by Doctor Costain. The fact that one animal out of a series of only thirteen can live for thirteen and one-half days is evidence that in a larger series, the probabilities of several animals recovering completely is not out of the question.

In a second series of twelve dogs, following the method of Doctor Costain the operation was done in two stages. At the first stage the appendix and meso-appendix were ligated and twenty-four hours later the duct was drained. One dog died in twenty-four hours with beginning peritonitis. Ten dogs died within forty-eight to fifty hours of the first operation. Post-

<sup>4</sup> Surgery, Gynecology and Obstetrics, March, 1923.

<sup>5</sup> Surgery, Gynecology and Obstetrics, Feb., 1924.

<sup>6</sup> Personal Communication.

<sup>7</sup> British Med. Journal, Oct., 1924, p. 1048.



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mortem revealing advanced peritonitis with gangrenous perforated appendices. One dog lived ten days. The post-mortem disclosed advanced peritonitis. In all of this series, drainage from the thoracic duct was satisfactory.

Summarizing the second series, we find that one dog died of peritonitis before the second operation could be performed. Ten dogs died within fifty hours of the first operation although the duct drained freely. One dog lived ten days and died of advanced peritonitis. When we compare these results with our controls in Series 1, we find that the dogs in this series did not live as long as the controls. The results indicate strongly that drainage of the thoracic duct in no way prolonged the lives of the animals, and on the contrary, appeared to hasten death.

Series 3 consisted of eleven dogs. We tied off the appendix and drained the thoracic duct at one stage. We thought that possibly the shock would be less, first because the absorption during the first twenty-four hours would be eliminated and second, the depressing effect of another operation and anæsthetic after so short an interval would be avoided. We found the additional time required for draining the duct to be almost negligible. In this series of drainage cases three dogs died within forty to forty-two hours with satisfactory drainage. Three dogs died within forty-eight to fifty hours with satisfactory drainage. One dog died in seventy-two hours. One dog recovered. This animal did not drain chyle for forty-eight hours, after which he drained profusely for five days.

Summarizing: We find that nine dogs died under fifty hours, although the drainage was satisfactory. One dog died in seventy-two hours. One dog recovered. It is important to note that the dog that recovered did not drain for the first forty-eight hours.

Now when we compare the series of animals in which the appendix has been ligated with the preceding series, in which the thoracic duct was drained, we find that practically the same number of dogs died in the same period of time. From this series it is evident that drainage of the thoracic duct in acute experimental peritonitis did not prevent the death of the animals.

Because of the fact that one dog in the preceding series recovered although there was no drainage for forty-eight hours, we decided upon a third series to determine the effect of ligating the duct. This series consisted of nine dogs. The appendix and the thoracic duct were both ligated at the same operation. Two dogs recovered. One dog died within twenty-four hours, a fistula having developed with profuse drainage. Three dogs died within forty-eight hours, two of which developed fistulæ, two lived seventy-two hours and one lived six days. Post-mortem examinations showed practically the same condition of peritonitis in different stages as in Series 2.

Summarizing: Four dogs died within forty-eight hours. Two dogs lived three days. One dog lived six days. Two recovered. In this series we ligated the duct, thereby preventing the chyle from passing into the circulation through the thoracic duct in the presence of developing peritonitis.

In general, the dogs lived longer than those in the preceding series, as shown by

- (1) The recovery of two dogs that did not develop a fistula.
- (2) One dog lived over six days.
- (3) Only four dogs died within forty-eight hours.

Of the dogs which died, it should be noticed that three developed fistulæ of the thoracic duct, the two that recovered and the one that lived six days, did not develop fistulæ. It would seem that the results of this series indicate that ligation of the duct retarded absorption of the toxin and postponed toxæmic death. Fistulous drainage appeared to hasten the death of the animal, probably by removing some of the actual nutrition upon which the animal was dependent. The results in this series of animals in which the thoracic duct was ligated would seem to indicate that the ligation prolonged the lives of the dogs by retarding absorption of the toxins.

Further experimental work was reported by Costain<sup>8</sup> with closed loop segments. He carried out a series of experiments with closed segments, closed loops and total occlusion of the duodenum and small intestine with and without drainage of the thoracic duct. His experiments indicate that the dogs which drained successfully recovered, while those which did not drain, died in about forty-eight hours.

We carried out a series of closed loop experiments, principally to test the clinical value if any, of draining the thoracic duct. We tied off a loop of jejunum six inches long, performed a lateral anastomosis three inches to either side of the site of ligation, obstructed the blood supply and the lymph supply to the loop, but did not drain the thoracic duct. This series consisted of two dogs. Death occurred within twenty-four hours. Post-mortem showed marked distention of the loop, which was black and gangrenous but not perforated. Beginning peritonitis was present.

Series 5 consisted of four dogs. The loop was ligated, enterostomy performed, the blood and lymph supply tied off, but the thoracic duct was drained. Three dogs died within thirty-six hours, although the duct drained satisfactorily. Post-mortem showed distention and necrosis of the loop. Beginning peritonitis was present in all cases. The fourth dog failed to drain for forty-eight hours, after which drainage became profuse for five days and then gradually stopped. This dog recovered.

Series 6 consisted of four dogs. The loop was ligated, the blood supply obstructed, but the lacteals were left open. The thoracic duct was drained. The animals all died within thirty-six hours, although the thoracic duct drained satisfactorily. The loop in three cases was gangrenous and perforated, while in the other it was black and distended.

From our experimental work with the closed loops, we must conclude that draining the thoracic duct did not materially prolong the lives of the dogs. The only dog which lived did not drain for the first forty-eight hours and then only for five days. There was practically no difference in the lethal

<sup>8</sup> Surgery, Gynecology and Obstetrics, Feb., 1924.

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period between the series in which the lymphatics were not obstructed, and the series in which they were ligated. Theoretically, in the latter series, the absorption of the toxins should have been delayed or prevented, until perforation occurred, but death occurred nevertheless within thirty-six hours. Although a number of cases of recovery following injury to the thoracic duct have been reported (see bibliography), there are cases on record that have terminated fatally.

Eyer<sup>9</sup> reported an injury to the thoracic duct with death by inanition. Bucknall,<sup>10</sup> Cheever<sup>11</sup> and Schopf<sup>12</sup> also reported fatal termination following operative injury to the duct.

It must be remembered that the location and anatomical structure of the thoracic duct is by no means constant. For example, Walsham<sup>13</sup> reported a case in which the thoracic duct ended on the right side at the junction of the internal jugular and subclavian veins. It is obvious that in such cases, drainage would be a difficult if not impossible procedure. In normal cases the chances for injuring important anatomical structures are great. Entrance into the mediastinum is a complication to be dreaded. Injury to the internal jugular vein and vagus nerve is quite possible.

In conclusion, we must remember that many cases of peritonitis will recover spontaneously.

In our hands drainage of the thoracic duct is by no means a simple procedure, and in view of the literature, we cannot believe it to be without danger.

We were unable to bring about a uniformly fatal peritonitis and so could not find a lethal standard.

Drainage of the thoracic duct did not prolong the lives of the animals, but appeared to hasten death. Ligation of the duct without drainage seemed to prolong the lives of the dogs.

The work of Costain has opened a large field of possibility. The importance which this procedure might have in the treatment of septic peritonitis cannot be overestimated. However, it would appear from our work that lymphaticostomy in the treatment of peritonitis should not be undertaken lightly. It would seem that further work of an experimental nature is needed before this procedure can be universally adopted.

We were able to carry out several experiments relative to absorption from the peritoneal cavity. Suspended carmen particles and methylene blue were injected into the free peritoneal cavity and in two cases appeared in the chyle from the thoracic duct within five minutes. In two other instances it did not appear within forty-five minutes. The results indicate that the rate of absorption through the thoracic duct is by no means constant.

<sup>9</sup> Eyer, A.: *Med. Records of N. Y.*, 1891, vol. xi, pp. 122-124.

<sup>10</sup> Bucknall, R.: *British Med. Journal*, 1905, p. 809.

<sup>11</sup> Cheever: *Boston Med. and Surg. Journal*, *Surg. Operations of Boston City Hosp.*, 1825, vol. xcii, p. 422.

<sup>12</sup> Schopf, F.: *Wien Klin. Wchnschr.*, 1901, vol. xiv, pp. 1169-1173.

<sup>13</sup> Walsham, W.: *J. Med. Research Boston*, 1903, vol. x, p. 153.

In regard to the technic employed, the internal jugular vein was identified and traced down to its junction with the subclavian vein, and the duct was found at its point of entrance. It was isolated for about half an inch, ligated near its entrance into the vein, and a longitudinal slit made in the wall of the duct. Little or no trouble was found in securing adequate drainage.

Breaking up of the duct into branches near its point of entrance was encountered four times and these animals were not used in the experiments. In all of the others the drainage was profuse.

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## SURGICAL EMERGENCIES OF THE ABDOMEN \*

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A REVIEW of the literature extending back over the last ten years revealed the fact that some fifty articles have been written on the "acute abdomen." The majority of the writers considered the condition from the standpoint of differential diagnosis, rather than making an attempt to show the early recognition and treatment. They speak of the great number of "medical abdomens" treated surgically and opened by mistake, but they have no figures upon the number of surgical abdomens treated medically and not surgically, until too late. By too late, I mean until the patient is *in extremis* from hemorrhage, the toxæmia of obstruction, peritonitis or pancreatitis. It seems to the writer that the important points are first, is the condition a surgical one, and second, does it demand emergency or immediate operation, and third, what is the actual diagnosis. For convenience in discussion, the surgical conditions are placed under four heads, viz.: (1) Abdominal traumatism; (2) acute abdominal inflammation; (3) intra-abdominal obstruction or strangulation, and (4) acute pancreatitis.

Abdominal traumatism may be in the nature of a (1) simple concussion or contusion; (2) contusion with visceral rupture, or (3) wounds of the abdominal walls with or without visceral injury.

The first class of cases usually presents more or less of the classical picture brought to mind by the expression "knocked out." Following an abdominal trauma, the patient will be in a state of shock termed by some authors sympathetic or abdominal shock. The face is pallid, the expression anxious (peculiar to abdominal shock), the skin is clammy, the pulse rapid, running and feeble, the temperature subnormal, the respirations shallow and rapid. The pupils are dilated and the eyes expressionless. Nausea is always present and vomiting usually occurs. The abdomen usually shows a protective rigidity, general or local. Peristalsis may be momentarily diminished or absent, depending upon the severity and distribution of the trauma. Pain is a prominent feature early. In extremely severe cases associated with unconsciousness or impending death, there may be no defensive rigidity but rather the normal muscle tone may be entirely absent. If there is no visceral injury the patient is most ill immediately following the accident and as recovery from shock occurs the pain ceases, the pulse drops, nausea and vomiting stop, and the abdominal rigidity is replaced by relaxation and merely a feeling of soreness remains. The above is the picture of what was termed by the older writers "peritonism" or "traumatic peritonitis" (non-inflammatory).

This condition requires rest, quiet, and the withholding of everything by mouth. The administration of whisky, aromatic ammonia or hot drinks is

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\* Read before the Philadelphia Academy of Surgery, February 2, 1925.



dangerous, because of the possibility of hollow visceral injury. These patients must be watched intelligently and closely and if nausea or vomiting or pain recurs, or if the pulse starts to mount, despite the fact that the temperature may still be subnormal, operation should be advised.

*Contusions with Visceral Injury.*—The signs indicative of an operative condition should not be those of a peritonitis or of a terminal anæmia. Persistent rigidity, if associated with nausea or vomiting, a pulse mounting and becoming weaker, an increasing anæmia, especially if associated with an increasing leucocytosis, absent or decreased peristalsis, indicate operative treatment. The pulse is probably the earliest and most reliable index in these cases.

The indications for operation are a failure of the patient to improve after recovery from the first shock, rather than to wait for the increase in the severity of the symptoms. Or if the period of improvement is replaced by a return of nausea, vomiting, pulse hurry, rigidity or pain. When in doubt, operate.

Most surgeons delay until they are sure of their diagnosis before they operate. The surgeon who operates early, that is when he has only well-founded suspicions of the need for operation, may occasionally operate needlessly, but he will save more patients than will his dilatory colleague. Rather open a suspicious abdomen needlessly than leave one dangerous one wait too long.

The definite diagnosis of the exact nature of the visceral injury in addition to being of academic interest will serve merely as an aid in planning the operative approach. This, however, is not of sufficient importance to warrant a delay in order to establish such a diagnosis. There are, however, many points which it may be well to consider. Abdominal hemorrhage may be extra-peritoneal. In addition to the symptoms of concealed hemorrhage there are also added those of peritoneal irritation, for we must remember that the outer surface of the peritoneum, whether it be of the parietes or of the mesentery, is extremely sensitive. Irritation of the same by blood results in nausea, vomiting, pain, rigidity and diminished peristalsis.

A negro was admitted to Service C at the University of Pennsylvania Hospital with the history that he was standing on a freight elevator when a 200 pound drum fell from above striking upon the elevator but not striking him. He immediately experienced pain in the abdomen, associated with nausea and vomiting. On admission, one hour later, his T.P.R. was 97,110,24. The abdomen was silent, rigid and tender, peristalsis was absent, his skin was leaky and cold. One hour later the pulse was 128. Operation revealed numerous petechial hemorrhages throughout the meso of the small intestines and even in the meso-appendix. No further injury was found. The patient recovered.

Another patient, a young man, was admitted to the Howard Hospital, shortly after being struck in the left groin with a tackle block. He was knocked unconscious, momentarily, and on recovery he experienced severe pain, nausea and vomiting, which continued. Peristalsis was absent and marked rigidity and tenderness were found. In the absence of improvement operation was done and a ruptured deep epigastric artery was found with a massive extra-peritoneal clot.

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Pre- and post-peritoneal hemorrhages are not, as a rule, as massive as are intra-peritoneal ones, hence do not result in as marked symptoms. Intra-peritoneal hemorrhage is usually associated with a rather definitely high leucocytosis with the anæmia. The spread of the blood between the coils of intestines frequently results in colicky pains superimposed upon the constant nauseating pain of the injury. A fine crepitation is often felt if gentle palpation is made over the abdomen, probably due to the roughening of the peritoneum caused by the fibrinous deposit or clot formation. Dulness in the flanks exists with uncertain frequency.

*Abdominal Contusion with Rupture of a Solid Viscus.*—If after a severe contusion to the abdomen signs of hemorrhage exist, suspicion should be directed to fracture of the liver because of its frequency.

Of the solid viscera within the abdomen the liver is the most frequently ruptured in subcutaneous injuries, 189 in a series of 305 cases. The rupture may be subcapsular or, as is more frequently the case, of a stellate type extending through the capsule and across the right lobe. Bullet and shell wounds also cause rupture. Symptoms of these ruptures of course depend on the severity of the injury. The most important ones are these of intra-peritoneal hemorrhage. The two serious conditions that may occur are rupture of a solid viscus or vessel with hemorrhage or rupture of a hollow viscus with subsequent peritonitis.

Pain, tenderness and rigidity in the upper right quadrant, dulness most evident in the right flank, pain in the right shoulder and often a bradycardia point to liver rupture. Finsterer found this shoulder pain true in thirteen cases from the literature. The right shoulder pain and bradycardia were both shown in two of the writer's cases quoted below.

A boy, eleven years of age, was struck in the right lower chest posteriorly with an army rifle bullet, which passed completely through his body, then through his right forearm to lodge just beneath the skin of the dorsal surface of the forearm. On admission to the hospital three hours later, his temperature was 97 and pulse 68. He had right shoulder pain and a leucocytosis of 22,000. Operation revealed a wound of the right diaphragm and lung, the right kidney and the liver, with the abdomen full of blood. The patient recovered.

A second case, a negro man, was struck by a swinging block of steel. On admission to the University Hospital, two hours later, his pulse was 56 and his only complaint was severe pain in the right shoulder and in his right hip. He was nauseated, but did not vomit. His abdomen was silent and rigid. Operation revealed a liver completely bisected. The pain in the hip was due to a dislocation. This patient died.

Common causes of fracture of the liver are falls from a height, or vehicles passing across the body. A vehicle passing across the body from right to left will rupture the liver most frequently, whereas if from left to right it will most often rupture the spleen. In many instances, rupture of the liver with hemorrhage may not require operative treatment. Such a case was the following: A negro man was admitted to the writer's service at the University Hospital with the history of a forty-foot fall, in which he sustained a fracture of the skull, a compound fracture of the right humerus, a fractured pelvis, a ruptured urethra, a fracture of the mandible and intra-abdominal

hemorrhage associated with pain and tenderness over the liver area. He was not operated upon and made a recovery.

*Treatment.*—Unless contra-indications exist, as in the above case, patients with rupture of the liver should be operated upon through a right rectus incision or a J-shaped incision and the liver sutured or packed with gauze, which should be protected with rubber dam as it is brought out through the abdomen. The blood can be collected from the abdomen with sponges and squeezed with sodium citrate solution and then transfused into the patient's veins, as is often done. The operative mortality of ruptured liver is from 60 to 80 per cent.

When a truck passes over the body from left to right and the picture of intra-abdominal hemorrhage is associated with a rapid anæmia, extreme prostration and left shoulder pain, a rupture of the spleen should be suspected and an immediate operation should be undertaken.

Treatment here consists of a left rectus or J-incision and most often a splenectomy is found to be necessary. The spleen is often pulpified or, as in one of the writer's cases, torn completely through, leaving one-half of the organ free in the abdominal cavity. Here, too, autotransfusion can be performed. Splenic rupture is most often fatal before operation can be performed. The operative mortality is under 50 per cent.

Rupture of the kidney occurs most often from trauma in the loin. The symptoms of hemorrhage appear slowly and are not marked as a rule. If the rupture is extra-peritoneal, as it usually is, the peritoneal signs are insignificant at first and the case is not an immediate emergency. If, however, signs of increasing peritoneal irritation develop in conjunction with hæmaturia, exploration is indicated at once, as such cases usually become infected later.

A ruptured ectopic pregnancy is usually accompanied by a severe pain in the abdomen, back and down the thigh, shock, fainting, nausea, but not always vomiting, followed by internal hemorrhage symptoms.

A ruptured bladder may be intra-peritoneal or extra-peritoneal. The catheter will establish the existence and the peritoneal irritation will place it as intra-peritoneal. A woman was admitted with a strangulated umbilical hernia. At operation hemorrhage was found in the pre-peritoneal tissue. A catheter revealed an ounce of blood and a suprapubic incision disclosed an intra-peritoneal rupture of the bladder. After the recovery from the anæsthetic she acknowledged that she had fallen downstairs, after which she developed the pain and vomiting and later the irreducible umbilical tumor. This illustrates the importance of placing the relationship of the vomiting and the incarceration of hernias. If the vomiting occurs first, look further than the hernia for its cause.

*Wounds of the Abdominal Walls.*—The diagnosis as to whether the wound does or does not enter the peritoneal cavity in these cases should not influence the course of action. They all should be explored. Under local anæsthesia the wound should be débrided layer by layer and the missile traced as far as

necessary. Great care should be taken not to open the peritoneum if it is not injured. A probe should not be used in these wounds as by it a tear may be made in the otherwise normal peritoneum and a complete exploration of the abdomen be necessary, in order to exclude possible visceral injury. This should be done at the earliest moment while only trauma and contamination exist and infection is forestalled. The day of hoping is past. Action is here. No one with operating facilities to-day is justified in postponing these cases one hour. It is true that many wounds of the abdominal wall do not penetrate the abdominal cavity, yet figures in the World War prove that the uniform withholding of operation resulted in a higher mortality than when operation was practiced routinely (Ashhurst). Wounds of the abdomen, twenty-four hours old, give the best mortality when treated non-operatively. The most insignificant of puncture wounds, whether made by a bullet, a knife, a splinter of wood, or any other penetrating object, should be explored at once, if the direction of the tract is toward the abdomen. The need for this is shown by the following case:

A young man was struck on the anterior aspect of the left thigh just below Poupart's ligament by a small stick of wood projected from a saw mill. A very small wound resulted and the case was not considered serious by the attending physician until later, when the patient became weak, pallid, leaky and thirsty and complained of abdominal pain. Examination revealed a dull, distended abdomen. The patient died and it was found that the stick of wood had passed upward under Poupart's ligament tearing its way through the femoral vein and into the peritoneum which later was filled with blood. Had the wound been explored the patient's life would have been saved.

When the wound is caused by a missile and is maybe at a distance from, but directed toward, the abdomen, immediate X-ray localization will help determine the likelihood or improbability of abdominal injury. A soldier was sent into my operating room in France with the fluoroscopic diagnosis of a shell fragment within the abdomen just beneath or above the posterior parietal peritoneum. As he had been struck but once and that in the thigh where there were both entrance and exit wounds, doubt was cast upon the diagnosis. On turning him it was found that a pebble under his blanket beneath his back was responsible for the shadow cast in the fluoroscope.

*Acute Abdominal Infections.*—Here again the early diagnosis of the need for operation is the important feature. In other words, the infection possibility should be diagnosed and the patient will be saved. Severe injuries to the abdomen resulting in rupture of a hollow viscus should be recognized by the early signs of peritoneal irritation. Sudden ruptures of a peptic ulcer, of a typhoid ulcer, or of an appendiceal abscess, give the signs of a catastrophe, severe sudden pain, prostration, shock, rigidity, tenderness, pulse hurry, nausea and vomiting. Persistent pain followed by nausea or vomiting associated with a rising pulse and diminished peristalsis should direct attention to surgery. One should not wait for temperature, leucocytosis, distention, absent peristalsis, etc. These are signs of a diffuse peritonitis. Operation should be done when the condition is one of local irritation and contamination. When the nausea and vomiting precede the pain and the above symptoms



are associated with diarrhoea, the case is usually a medical one, with the exception of an intussusception.

I am referring merely to emergency conditions now and not to the more frequent acute infections that take hours to develop a dangerous condition. The making of the actual diagnosis is very satisfying, but should not be the cause for delay. This is becoming more and more evident as times goes on. It is the usual thing now to have one's interne state, for example, that there is an "acute abdomen" just admitted that "looks like appendicitis."

In making a differential diagnosis a few points may be of interest. Acute abdominal pain ushered in by a chill and a subsequent fever of 104 plus a high leucocytosis usually is due to some extra-peritoneal infection, pneumonia, pyelitis, or intra-uterine infection. When an acute appendicitis is accompanied by a chill, it usually means a severe type by reason of the class of infection organism or a pylephlebitis. The pain of a ruptured peptic ulcer is agonizing and associated with a board-like rigidity. These two symptoms demand immediate operation. Vomiting may occur but once or twice in the first two or three hours. If the ulcer perforates in the lesser peritoneal cavity the pain will be referred chiefly to the back. An acutely inflamed appendix may lie in the pelvis and announce its existence merely by midline pain *above* the umbilicus together with painful defecation, there being no rigidity, tenderness in the iliac fossa, temperature, vomiting or other signs of peritoneal infection. This is a case for emergency surgery as the absence of signs renders it a dangerous tenant.

The retro-peritoneal, retro-cæcal or retro-colic appendicitis, associated with little or no anterior abdominal signs, insignificant nausea, no vomiting, no colic, normal peristalsis, but a fever of 103, leucocytosis, 26,000-30,000 and little tenderness and rigidity, requires early surgery as these are the cases which, if neglected, result in necrosis of the cæcum and post-operative fœcal fistula, in subdiaphragmatic abscesses, pylephlebitis, liver abscess and death.

Temperature, pulse hurry and leucocytosis are of secondary importance in the diagnosis of acute appendicitis. The three symptoms most constant and most reliable are pain, tenderness and rigidity. The rigidity and tenderness are over the appendix whether it lies extra-cæcal at McBurney's point or in the pelvis as in the following case:

A boy, nine years of age, was admitted to Service C, University of Pennsylvania Hospital, because of inability to urinate except with difficulty and great pain, beginning two days previous. The history revealed the fact that ten days before he had had indigestion from which he recovered, then being up and around at school. Physical examination revealed exquisite tenderness and rigidity in the suprapubic region. Rectal examination disclosed a tender area above the bladder. Diagnosis—appendiceal abscess. Operation confirmed the diagnosis.

The appendix is responsible for the great majority of acute abdominal infections. The predominance is most marked in children. The cases of appendicitis following closely upon an acute pharyngeal or nasal infection, or influenza, also requires urgent surgery as they are frequently of a streptococcic type and run a rapid course to early perforation, or peritoneal infection



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without perforation. Cases where the pain starts in the appendiceal area from the beginning and remains there usually perforate early and the perforation occurs near the base of the appendix. In any case of acute appendicitis where vomiting recurs after localization of the pain in the iliac fossa or over the appendix, immediate surgery is indicated, as this symptom means re-invasion of the peritoneum following a rupture of the retained infection which may have been still in the appendix or in a local abscess. It is true that the infection from a ruptured appendix tends to localize, but it is foolhardy to wait. Immediate operation is the treatment for acute appendicitis.

Meckel's diverticulitis should not be overlooked as a cause for urgent surgery. This diagnosis is seldom made and found present. It is often made and the operation reveals an acute appendicitis. The differential diagnosis cannot be certain. Primary peritonitis does occur probably due to migration of the infection through intestinal walls. This frequently is preceded by a gastro-enteritis and is oftentimes of a streptococcic nature also. Such was the condition in a recent case.

A woman thirty-six years old had been sick with diarrhoea, nausea, vomiting, colicky pains and prostration for forty-eight hours, following the ingestion of some fish. On the third day, eighteen hours before admission, she developed a chill, with a temperature of 103 and leucocytosis of 18,000, associated with pain, tenderness and rigidity over the lower abdomen. Operation revealed a diffuse peritonitis of the streptococcic type. She recovered after a stormy period.

In older patients with the initial pain in the left lower quadrant, associated with local peritonitis, the underlying cause is usually a ruptured diverticulitis or a malignant ulceration.

*Abdomen of Obstruction and Strangulation.*—Colicky pains associated with hyperperistalsis and obstipation indicate intestinal obstruction and immediate operation should be performed. The practice so often indulged in of procrastination because of a small amount of faeces or gas recovered from the bowel below the obstruction leads one to hope for a relief of the condition. The old advice of "never let the sun go down on a case of intestinal obstruction" is a good one. Delay and waiting for distention and stercoraceous vomiting is not warranted. It is in recent laparotomy cases that most delay occurs. Cases of obstruction operation under 24 hours give 80 per cent. to 90 per cent. recovery; under 48 hours, 75 per cent.; under 72 hours, 30 per cent. to 40 per cent. Intussusception is the worst offender in mortality. Wichman analyzed 724 cases, only 223 of which were operated, 73 of which recovered, making a mortality of 90 per cent. Probable failure to recognize the condition early is responsible.

The diagnosis often must be made in the absence of hyperperistalsis, distention and obstipation, as in cases of high jejunal obstruction. These cases advance rapidly, become toxic in a few hours, have high pain and an early pulse hurry.

Richter's hernias of the femoral variety take a most peculiarly slow course and develop real positive symptoms slowly. In all elderly people, especially

females, intestinal pain and excessive peristalsis in the absence of diarrhoea should lead one to examine carefully the femoral regions.

Malignancy obstruction may occur suddenly and without history. These usually require a left paramedian incision based on the greater frequency on the left side.

Internal hernias through mesenteric rents, into fossa, etc., demand a right paramedian incision for exploration. In cases following an old operation it is best to incise near the old scar.

Persisting obstipation and increased peristalsis and pain usually mean surgery. If done early, relief of the obstruction is performed, but if done late when patient has a high pulse from toxæmia, an enterostomy only should be done as the urgent measure.

Mesenteric thrombosis and embolism cause sudden obstructive symptoms accompanied most often by severe sudden pain. If the occlusion occurs high the patient is true to type of high obstruction and in addition may vomit blood as did the following case:

A young man, thirty-two years of age, was under Dr. Wm. C. Posey's care for retinal hemorrhages of an unexplained etiology. He was suddenly seized with an agonizing pain in the upper abdomen accompanied by frequent intractable vomiting and in a few hours hæmatemesis of a bright type. Operation revealed a thrombosis of the vein supplying the upper six feet of jejunum. The patient died following resection.

This condition of embolus and thrombosis is most frequent in elderly people with vegetative cardiac valves. The condition can be recognized only as a catastrophe that requires immediate surgery. Trotter collected 366 cases, only 13 of which were diagnosed. Cases of strangulation of the gut in obstructed conditions should come to operation early enough to obviate any necessity for a resection. Obstruction symptoms occur first and irreparable strangulation only after hours have elapsed.

The advice to the surgeon for all intestinal obstruction cases is to get in quickly and get out more quickly, accomplished by early diagnosis and an adequate incision.

*Acute pancreatitis* demands early operation. The symptoms uniformly present are sudden agonizing pain in the epigastrium and in the back especially, unrelieved by massive doses of morphia. Intractable vomiting and nausea are present. The face invariably shows a peculiar typical leaden or slate color. The patient is shocked and the pulse is high. Peristalsis may or may not be effected; it is usually diminished. Temperatures, distention and leucocytosis are secondary in importance. The pain frequently, after a few hours, has a right iliac reference. The condition occurs usually in stout patients of from forty to fifty years of age and is fatal in approximately 60 per cent. of cases. Immediate operation and pancreatic drainage are required.

A woman, thirty-eight years of age, of stout build, was admitted to Service C at the University Hospital, having been attacked with sudden severe agonizing pain twelve hours previous. She was ashen, restless, with pain in the back which a grain of morphia had not relieved. The pulse was 128, the temperature 97, leucocytes, 11,000, and the pain reference was in the right iliac fossa. Rigidity was marked over the epigastrium and

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lower right quadrant. The operative diagnosis was shown to be acute gangrenous pancreatitis. The abdomen was filled with fat necrosis and a dirty brownish fluid.

The post-operative care for these emergency cases is morphia for pain that causes restlessness, nothing by mouth until peristalsis returns, proctoclysis by Murphy drip. First pint of tap water and tincture digitalis f5ii, second pint 2 per cent. soda bicarb and third pint 2 per cent. bicarb and 5 per cent. glucose, hypodermoclyses of normal salt and 1/32 per cent. novocaine, and later, if the rectum is refractory, glucose and soda water under the skin or in the vein; continuous flaxseed poultice to the abdomen, Fowler position, fruit lozenges or chewing gum for the mouth as a parotitis preventive, digitan hypodermically fourth hour and the stomach tube for vomiting.

No attempt has been made in this discussion to cover all conditions causing an acute abdomen, but merely those that should have immediate surgical care. Finally it might be stated that persistent abdominal pain followed by nausea and vomiting, tenderness and rigidity and constipation should incline one to a surgical diagnosis, whereas nausea and vomiting following by pain and diarrhoea, should lead one to suspect a medical condition, except in the presence of a pelvic abscess or an intussusception.

## ON THE VIABILITY OF THE INTESTINE IN INTESTINAL OBSTRUCTION\*

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ONE of the greatest difficulties encountered in the surgery of intestinal obstruction is the management of gut of doubtful viability. Should it be returned? Should it be resected? On occasions such gut has been returned to the peritoneal cavity in the belief that the circulation would take care of itself. If not, the involved segment could be subsequently removed should alarming symptoms develop. If it is left *in situ* the circulation may return and result in recovery or the segment may become gangrenous with or without rupture and result fatally. Often gut which is apparently not viable has been accidentally or deliberately returned to the abdomen and in some instances the patient recovered.

### CASE REPORTS

CASE I.—SN 9, Male, age sixty-four. Type of obstruction—strangulated right femoral hernia. Pathology found at operation and operative treatment—hernial sac contained several c.c. of serosanguineous fluid and 20 cm. of black gut with strangulated omentum. Omentum resected. Lustre and color returned to segment after application of hot pads sufficiently to warrant its replacement (Plate 1b). Post-operative course—patient died four days after operation with signs of paralytic ileus. Wound inspection—gangrenous segment of gut found. Remarks—viability of the gut questionable, resection considered. Circulation apparently returned but subsequently became impaired resulting in gangrene of the segment.

CASE II.—SN 126, male, age twenty-six. Type of obstruction—intussusception. Pathology found at operation and operative treatment—free serosanguineous fluid in the peritoneal cavity, 60 cm. of ileum telescoped into cæcum and ascending colon. Reduction of intussusception was not difficult. About 10–15 cm. of reduced ileum (intussusciens) appeared dark in color. After applying hot pads the color and luster returned sufficiently to warrant its replacement (Plate 1c). Post-operative course—paralytic ileus and pneumonia developed. The patient succumbed on the eleventh day. Autopsy—pneumonia and a gangrenous segment of ileum 10–15 cm. in length. Remarks—viability of the gut questionable, resection considered. The pneumonia was the obvious cause of death. The question arises however, if the patient would have survived as the circulation after having apparently returned became permanently impaired.

CASE III.—SN 31, male, age sixty-eight. Type of obstruction—strangulated right indirect inguinal hernia. Pathology found at operation and operative treatment—the hernial sac contained several c.c. of serosanguineous fluid and 20 cm. of dark gut. The circulation returned except in two small areas (Plate 1c). Peristalsis observed, gut replaced. Post-operative course—patient died one week after operation following a stormy post-operative course. Wound inspection—segment of gangrenous gut. Remarks—viability questionable, resection considered. Circulation apparently returned except in two small areas but subsequently the entire segment became devitalized.

\* Read before the Clinical Society of the New York University and Bellevue Hospital Medical College, April 25, 1924.

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CASE IV.—SN 8, male, age seventy. Type of obstruction—strangulated left recurrent sliding hernia. Pathology found at operation and operative treatment—several c.c. of sero-sanguineous fluid and a loop of ileum 30 cm. in length, dark blue in color, caught under a band extending from one portion of the sigmoid to the other. The band was cut, the circulation returned to the segment (Plate 1c). Post-operative course—patient died three days after operation. Wound inspection—gangrenous segment. Remarks—gut became gangrenous after apparently appearing viable.

CASE V.—SN 28, male, age forty-eight. Type of obstruction—volvulus the result of bands and adhesions. Pathology found at operation and operative treatment—about one litre of serous fluid escaped on opening the peritoneal cavity. Several coils of small intestine were dark blue in color. The obstruction was produced by a distinct band extending from site of old epigastric hernia to ileum. The band was cut and ligated. After the application of hot pads the circulation returned to the strangulated loops sufficiently to warrant their replacement (Plate 1d). Post-operative course—patient died ten hours after operation. Wound inspection—

serosanguineous fluid and two loops of intestine which were gangrenous. Remarks—viability of the gut questionable, resection considered. The patient was obstructed

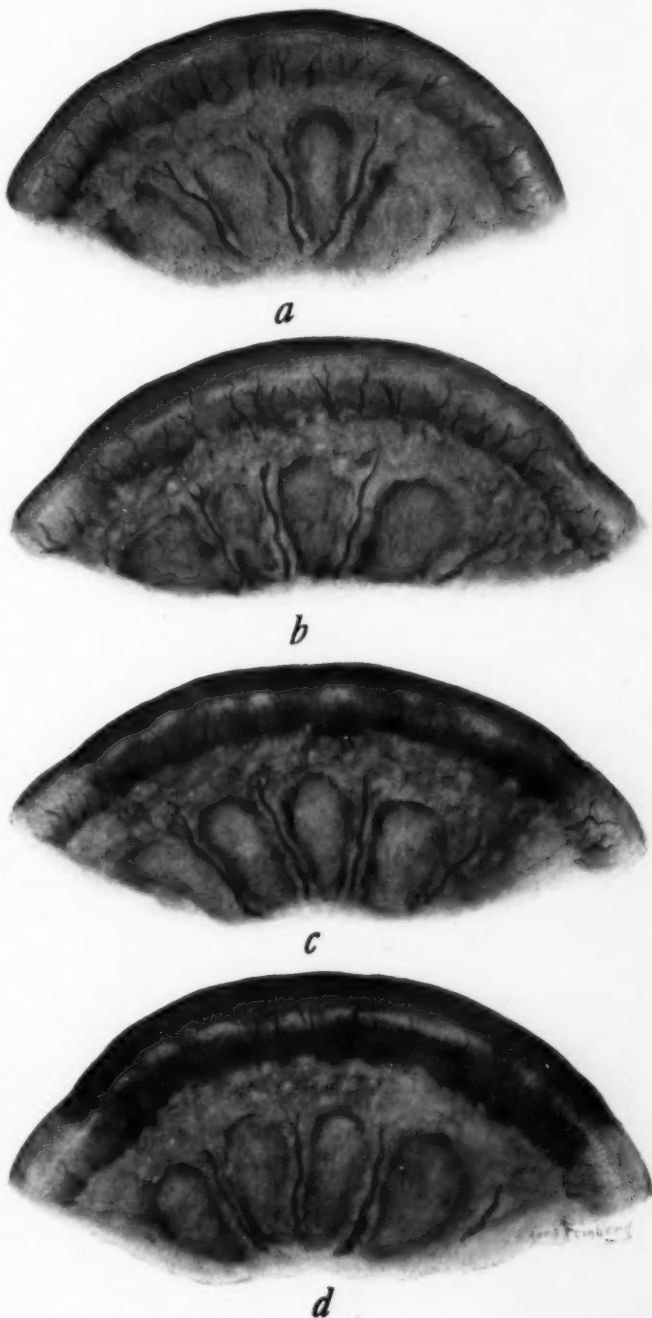


PLATE 1.—Intestine of the dog. a. Normal. b, c, d. Degrees of questionable viability.



five days before operation. The loops were apparently viable but subsequently became devitalized.

CASE VI.—SN 32, female, age thirty-one. Type of obstruction—strangulated right femoral hernia. Pathology found at operation and operative treatment—serosanguineous fluid and a segment of intestine 10 cm. in length, black in color were found in the hernial sac. The loop was deliberately returned to the peritoneal cavity. Post-operative course—the patient made an uneventful recovery. Remarks—gut apparently not viable. Circulation was impaired and the segment was deliberately returned to the peritoneal cavity without ill effects.

CASE VII.—SN 6, female, age forty-four. Type of obstruction—strangulated right indirect inguinal hernia. Pathology found at operation and operative treatment—about

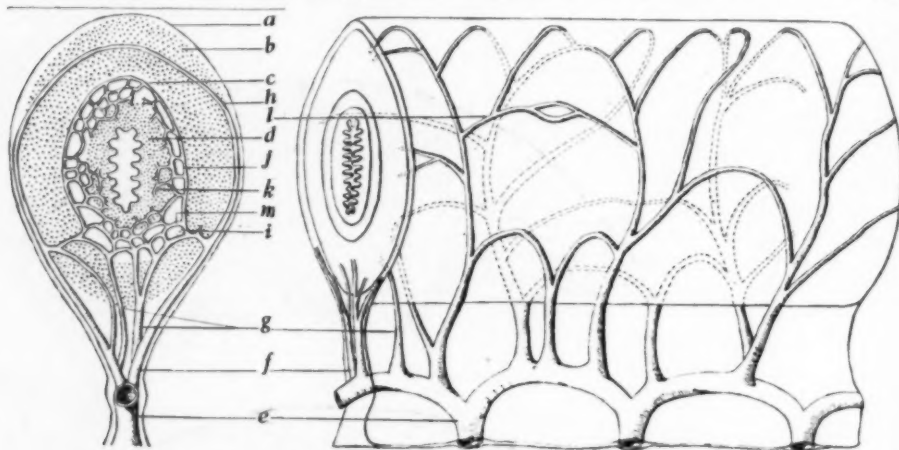


FIG. 1.—Transverse and longitudinal views of intestine (diagrammatic). a, serosa; b, muscularis; c, submucosa; d, mucosa; e, terminal arcade; f, vasa recta; g, smaller arteries at mesenteric border; h, vasa recta piercing muscularis; i, muscular plexus; j, submucosal plexus; k, mucosal plexus; l, lateral anastomosis; m, right-angled vessel to vertical axis of gut.

250 c.c. of serous fluid and three loops of small gut present in hernial sac. One loop was 30 cm. in length and black in color. The other two were congested. While cutting restriction at neck of sac the loop which was black and lustreless accidentally slipped back into the peritoneal cavity, no attempt was made to recover the loop. Post-operative course—the patient recovered after a stormy convalescence. Remarks—gut apparently not viable. The blood chemistry showed an increase in the toxæmia after the obstruction was removed and continued for several days before a return to normal was noted.

In the first five cases the gut was of questionable viability. The degree of circulatory impairment is depicted in Plate 1 as it appeared in the segments just before they were replaced. (Case I—Plate 1b; Case II—Plate 1c; Case III—Plate 1c; Case IV—Plate 1c; Case V—Plate 1d). Resection was not performed because of a previous personal conception based upon clinical observations that strangulated gut, as described above, recovers. This opinion was strengthened by the viewpoint of other surgeons, who believe that gut will recover unless it is actually gangrenous. Cases VI and VII, in which the gut was apparently not viable, were examples which seemed to justify their contention.

Since there is such uncertainty in the outcome of a strangulated segment of intestine unless it be resected, several questions arise: Is there a factor of safety in the number of vessels that can be impaired with impunity? How

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does the circulation become reestablished in an impaired segment of intestine and why the production of a gangrenous segment in an apparently viable one?

In an attempt to explain the varying results in these cases, the following anatomical and experimental study was undertaken. It has been shown by Dwight,<sup>1</sup> Monks<sup>2</sup> and Mall<sup>3</sup> that there is a free anastomosis in the mesentery and the intestinal wall. The writer<sup>4</sup> has verified these findings and has

shown that the vasa recta, while encircling the intestine, give off branches which in anastomosing converge toward the lumen and run more or less parallel to the longitudinal axis of the intestine. The vasa recta are not end arteries. In addition, there are numerous smaller arteries at the mesenteric border which inosculate with one another and the vasa recta, completing a more or less concentric anastomosis. (Figs. 1 and 2). In the large intestine, Rost<sup>5</sup> calls attention to the fact that there is a marginal vessel. In the small intestine the arches of the last arcades also run more or less parallel to the mesenteric border of the gut and can be regarded

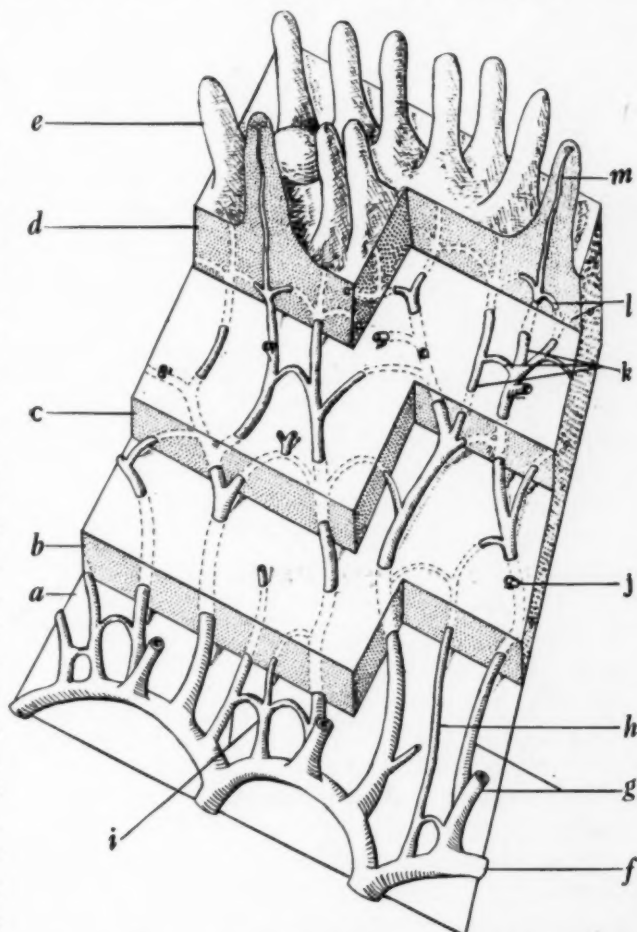


FIG. 2.—Reconstruction of human intestine showing relationship of arteries to intestinal coats (diagrammatic). a, serosa; b, muscularis; c, submucosa; d, mucosa; e, villus; f, terminal arcade; g, vasa recta; h, smaller arteries at mesenteric border; i, anastomosis of smaller arteries at mesenteric border; j, right-angled vessel to vertical axis of gut; k, submucosal plexus; l, mucosal plexus; m, artery to villus.

as a marginal vessel with numerous incoming branches. The fixation of the large bowel compensates in part for the few incoming branches and arcades. The duodenum has a marginal vessel and is partially fixed. Figures 3 and 4 are a diagrammatic representation of the intestinal circulation in the dog and human, respectively. The similarity in the arrangement of the mesenteric circulation is clearly shown.

Thus, recovery should readily follow after strangulation, provided the obstructing agent is removed before gangrene develops. Unfortunately, this is not so. Hence, other factors must be sought.

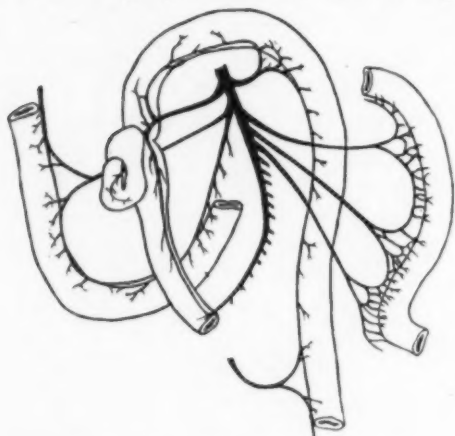


FIG. 3.—Mesenteric circulation in the dog (after O. C. Bradley).

of vessels of the first arcade, Fig. 5g, or vasa recta, Fig. 5c, d, and Fig. 6f. It is nil following the ligations of the aa intestinalis, Fig. 5f, colic vessels, Fig. 6e, and oblique ligations of the second arcade in which the terminal arch and vasa recta are included. The active return of the circulation after experimental ligations of vessels of the second arcade is readily explained anatomically by the very free anastomosis. In the human this is considerably increased because of the greater number of arcades. Compare Figs. 3 and 4. The lessened factor of safety in the ligations of the vasa recta and smaller vessels at the mesenteric border was not so clear because of a well-established anastomosis in the submucosa and mucosa. (Figs. 1 and 2.)

Anatomical experiments by injecting a pigmented gelatin into segments of intestines with similar ligations gave almost parallel results except in the ligations of the vasa recta. It was found that the fluid carried only in a few instances following the ligation of one vessel and in no instance after ligation of more than one vessel. However, in living tissue three to four vasa recta could be ligated. (See Table I.) Welsh and Mall<sup>8</sup> brought out the fact that if more than 5 cm. of intestine were separated from its blood supply gangrene results. In our experiments, if

The work of Rydigier,<sup>6</sup> Madelung,<sup>7</sup> Welsh and Mall<sup>8</sup> showed that it was impossible to establish any definite rules as to which vessels of the mesentery of the small intestine could be ligated without danger of gangrene. Similar experiments were carried out.<sup>9</sup> It was found that the margin of safety in the dog was greatest following ligations of vessels of the second mesenteric arcades, Fig. 6b. There is a considerable decrease in this factor after ligations



FIG. 4.—Mesenteric circulation in man (diagrammatic).

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the vasa recta and smaller arteries are ligated, gangrene invariably follows if the involved segment is more than 3 cm. of contracted intestine. Mall<sup>10</sup> has shown that 25 cm. of gut shortens to 15 cm. and becomes ischæmic during contraction.

TABLE I

*Showing the Comparative Results Obtained After Ligation of Various Vessels in the Return of the Circulation to a Segment of Gut on Dogs and the Range of Flow of Injection Fluid to the Vasa Recta*

Results of animal experiments	Vessels ligated	Results of injection experiments
N R	aa. intestinalis primary arcade	N R
R	one vessel	R
N R	two vessels	R
N R	three vessels secondary arcade	N R
R	one vessel	R
R	two vessels	R
R	three vessels	R
N R	two vessels (oblique ligation including vasa recta at extremes) vasa recta	N R
R	one vessel	R
R	two vessels	N R
R	three vessels	N R
R	four vessels	N R
N R	five vessels	N R
Circulation returned = R		Vasa recta injected = R
Circulation did not return = N R		Vasa recta not injected = N R

The vasa recta pierce the muscularis in the mesenteric quarters of the small intestine and the anti-mesenteric quarters of the large intestine, Figs. 7a, b. There is a very poor anastomosis in the muscular coats of the intestine.<sup>4</sup> Ligation of the vasa recta at the mesenteric border causes a contraction and spasticity of the musculature supplied. This contracture further constricts the vasa recta in the musculature before they inosculate freely in the sub-mucosa and mucosa, thereby further interfering with the establishment of a collateral circulation. However, there must be another factor, inasmuch as the muscular action does not come into play in the anatomical injection experiments. Apparently there is a mechanical factor of resistance at the anastomosing points where the calibre of the lateral branches from the contiguous vasa recta are smallest.

In all experiments, whether the circulation returned or the gut became gangrenous, the omentum was found wrapped around the strangulated segment. In some cases adhesions were found between the involved segment and normal coils of gut. In those cases in which the circulation returned or became reëstablished microscopic examination showed damage to the intestinal wall. The degree of these changes depended upon the length of time the involved segment was left *in situ* before removal.

*Pathological Report.*—Figure 8, Specimen No. 17—changes due to the ligation of vasa recta. In the mucosa there is an increased number of goblet cells, dead and dying

epithelial cells, debris in the acini and some round-cell infiltration. There is a marked round-cell infiltration in the submucosa and to a less degree in the muscular coats. The muscle layers show degeneration and some fibrous replacement.

Figure 9, Specimen No. 23a—changes due to the ligation of vasa recta. There is greater atrophy of muscle cells with fibrous replacement.

Figure 10, Specimen No. 30—changes due to the ligation of vasa recta. The goblet cells are less in amount. The musculature shows little if any degeneration or fibrous replacement. There is a great increase in fibrous tissue at the serosa.

From these experiments and clinical observations, it is probable that the

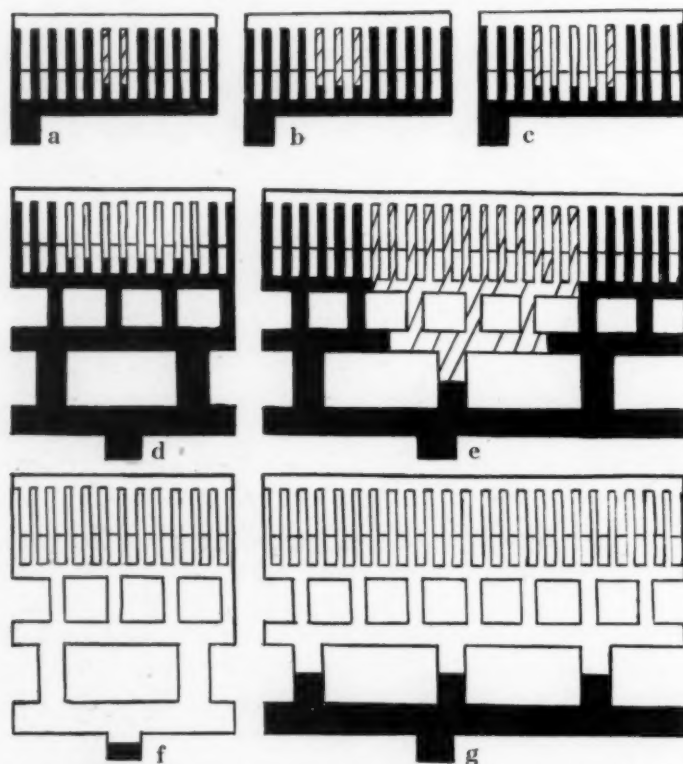


FIG. 5.—Diagrammatic representation of various experimental ligations. Black—no change in circulation. Diagonal lines—return of circulation. White—circulation did not return. a, duodenum—two vasa recta ligated—circulation returned; b, duodenum—three vasa recta ligated—circulation returned; c, duodenum—five vasa recta ligated—circulation returned at extremes of segment—central portion gangrenous; d, jejunum—eight vasa recta ligated—circulation did not return; e, jejunum—one vessel first arcade ligated—circulation returned; f, jejunum—aa intestinalis ligated—circulation did not return; g, jejunum—three vessels first arcade ligated—circulation did not return.

adhesions. Clinically, there are cases in which the circulation is apparently in good condition at the time of operation, but later becomes impaired. Here the sudden release of the obstructing agent probably has allowed emptying of the veins with an inrush of blood through the arteries. A momentary return of the circulation is noticed. Soon after the involved area being too large, the damage to the vessel wall too great, associated with a spastic muscular contracture, there is a secondary circulatory impairment. The collateral anastomosis, omentum and adhesions are here insufficient to compensate.

the circulation returns in one of the following ways: A return circulation through the original temporarily occluded vessels (clinically); a return or reestablishment of the circulation (clinically and experimentally), the result of a collateral circulation. The development of adhesions between loops of gut and the omentum are beneficial to the recovery of the affected gut. As yet, there is no evidence of the formation of new blood-vessels through these



## VIABILITY OF INTESTINE IN OBSTRUCTION

Clinically, whether a hernia, volvulus, intussusception, etc., the consideration of the treatment of a strangulated loop is the same. The treatment will not be discussed in early cases where the circulation is not impaired and late cases where the gut is gangrenous with an associated paralytic ileus.

The important group is the intermediary type of case in which the viability of the gut is questionable. The terms, early, intermediary and late were based upon experimental data previously published.<sup>11</sup> An early case is one in which the circulatory disturbances have not injured the segment of gut

to any perceptible degree, whereas in a late case the segment of gut has lost its viability beyond repair. In the intermediary class the segment is damaged but not beyond the possibility of repair. Other factors which must be considered in this classification are the proximity of segment to lethal line in the duodenum, size of the segment and most important, whether the

circulation is immediately or gradually occluded. In other words, a strangulated segment 20 cm. in length in which the circulation is immediately occluded, located in the jejunum or ileum, is early within a few hours and late within twenty-four hours. A loop three times as large in the same location with the circulation immediately occluded is late within a few hours. On the other hand, a loop 80 cm. in length through a rent in the mesentery, where the circulation is gradually occluded, is early within twenty-four hours and does not become late until forty-eight to fifty hours, when the circulation is fully occluded. It is obvious that this classification cannot be designated in

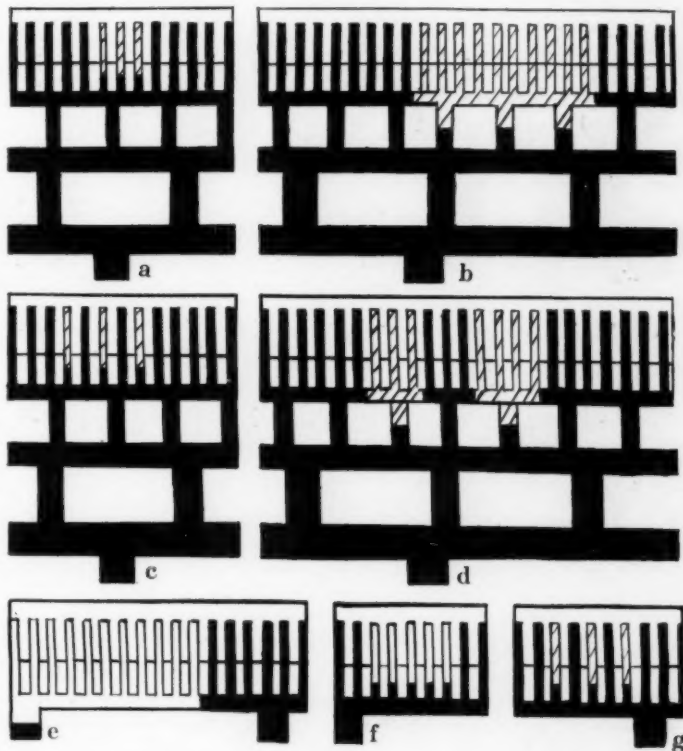


FIG. 6.—Diagrammatic representation of various experimental ligations. Black—no change in circulation. Diagonal lines—return of circulation. White—circulation did not return. a, ileum—two vasa recta ligated—circulation returned; b, ileum—three vessels second arcade ligated—circulation returned; c, ileum—three alternating vasa recta ligated—circulation returned; d, ileum—two alternating vessels second arcade ligated—circulation returned; e, colon—middle colic vessel ligated—circulation did not return; f, colon—five vasa recta ligated—circulation did not return; g, colon—three alternating vasa recta ligated—circulation returned.

units of time, but depends upon the above factors which cannot be positively determined until operation.

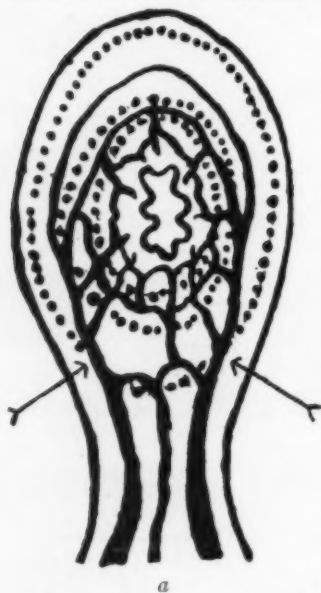


FIG. 7.—a. Longitudinal section of human small intestine. Arrows point to entrance of vasa recta in the mesenteric quarters.

The intermediary type of case includes those cases in which the circulation has apparently returned sufficiently to warrant the replacement of the intestine and those cases in which the circulation returned sluggishly and apparently is not viable. To consider the gut viable there must be a rather rapid return of the circulation as manifested by color and lustre. The segment may be cedematous but there should be no line of demarcation of color between the normal and the involved intestine. Palpation of the mesenteric arteries as pointed out by Kocher is very important. In addition, the writer palpates the vasa recta at the mesenteric border. The vessels must be pulsating throughout the entire segment and special attention should be paid to the vessels located in the central portion of the segment. The age of the patient with relation to the condition of his arteries is very important. The evidence of general arterial changes makes

resection more of a necessity. If there is any question of doubt, resection with immediate reconstruction is the operation of choice.

#### CASE REPORT

CASE VIII.—SN 107, female, age twenty-seven. Type of obstruction—volvulus of the small intestine. Pathology found at operation and operative treatment—a segment of gut 40 cm. in length, black in color, was present with serosanguineous fluid in the peritoneal cavity. After removal of the obstructive band and the application of hot pads the circulation returned sufficiently to warrant its replacement (Plate 1d). As a result of previous experience in experimental work resection with an end-to-end anastomosis was performed. Post-operative course—uneventful recovery. Remarks—immediate reconstruction of the canal was decided upon as there were no complications.

If complications are present the segment may be delivered outside the peritoneal cavity with drainage above the obstruction. The segment is later resected. Immediate reconstruction of the canal at this time depends upon the

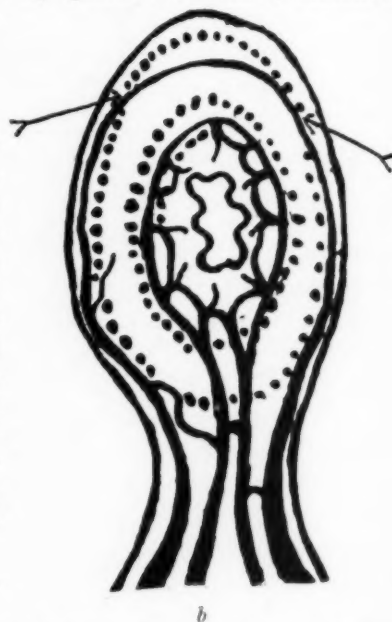


FIG. 7.—b. Longitudinal section of human large intestine. Arrows point to entrance of vasa recta in the anti-mesenteric quarters.

## VIABILITY OF INTESTINE IN OBSTRUCTION

condition of the patient and the proximity of the segment to the duodenum. The segment is not left upon the abdomen with any thought of allowing a subsequent return of the circulation, but to avoid further operative shock to a patient in poor general condition. Experimentally it has been shown that removal of a devitalized segment, regardless of its location, is essential to the life of the animal. Furthermore, no ill effects result if it is left outside the peritoneal cavity without removing it, provided the oral gut is drained.<sup>12</sup>

### CASE REPORT

CASE IX.—SN 10, female, age twenty-four. Type of obstruction—volvulus of sigmoid complicated with pregnancy at term. Pathology found at operation and operative treatment—segment of colon 80 cm. in length, dark in color, dilated five times its normal size was found with serosanguineous fluid in the peritoneal cavity. After untwisting the volvulus and repeatedly applying hot pads the circulation slowly returned (Plate 1c). Although the segment was

apparently viable it was left upon the abdomen and a large tube inserted in the oral colon (Fig. 11). Resection was not performed owing to the poor condition of the patient. Twenty-four hours later the segment was devitalized and was resected at the patient's bedside without anaesthesia. Reconstruction of the canal was left for a later date. Several days later the patient was delivered of a dead child at term. Finally after a stormy convalescence the patient recovered. About five months after a lateral anastomosis was performed. The patient succumbed several days later with signs of general peritonitis. Wound inspection—general peritonitis due to a leak at upper angle of anastomosis.

From all the evidence presented, leaving gut of questionable viability in the peritoneal cavity with the idea that it is just as safe to resect within twenty-four hours, is to be condemned. For these twenty-four hours are very important hours in the determination of the prognosis. A fatal toxæmia can result within this time if the segment does not become viable. The fact that a certain number of these cases have recovered in which the circulation

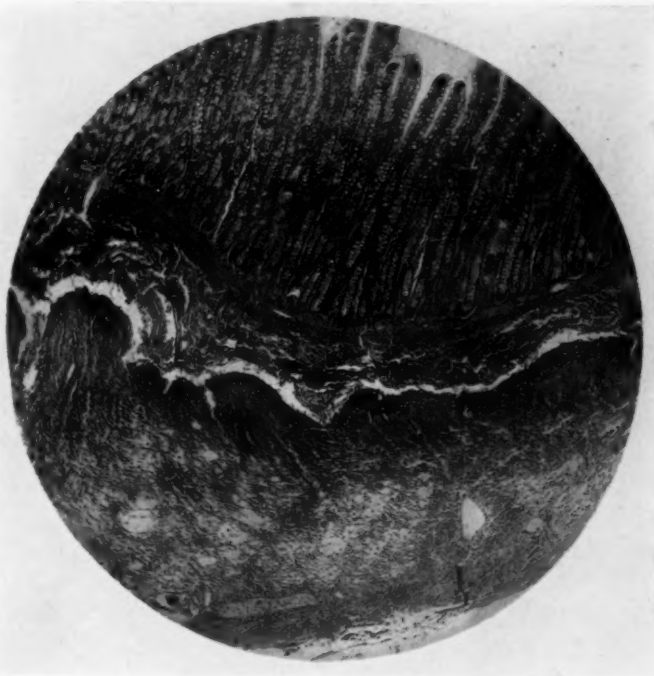


FIG. 8.—Photomicrograph showing effects of ligation of vasa recta.



FIG. 9.—Photomicrograph showing effects of ligation of vasa recta.

was impaired at the time of operation and became reestablished should not be a criterion against resection, for a great number of these cases do die from this cause as shown by autopsy.

#### CONCLUSIONS

1. It is often difficult to determine the viability of strangulated intestine.

2. Although there is a rich anastomosis in

the mesentery and intestinal wall, comparatively slight interference with this circulation causes disproportionately great damage to the intestine.

3. Experimental ligation of the vessels of the second mesenteric arcades is the safest.

4. The circulation returns or becomes reestablished in an impaired segment, either through the temporarily occluded vessels or as the result of a collateral circulation.



FIG. 10.—Photomicrograph showing effects of ligation of vasa recta.

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5. The circulation does not return and the segment becomes gangrenous if the involved area is too large and there is too great a trauma to the vessels with a prolonged spastic muscular contracture.

6. The classification of strangulated bowel into early, intermediary and late, does not designate units of time. This depends upon the size of the



FIG. 11.—Photograph of Case IX, showing volvulus of sigmoid twenty-four hours after primary operation. a. Oral drainage tube. b. Drainage tube in segment. c. Peritoneal drainage.

segment, its proximity to the duodenum, and whether the circulation is immediately or gradually occluded.

7. In the intermediary type resection with immediate reconstruction of the canal without drainage is the most satisfactory procedure.

8. If systemic complications are present, the involved segment is left upon the abdomen with oral drainage of the intestinal canal. Resection and reconstruction are later performed either in one or two stages.

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## THE RÔLE OF THE PYLORO-DUODENAL NERVE SUPPLY IN THE SURGERY OF DUODENAL ULCER\*

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AS EARLY as 1910, I had in various publications, insisted upon the great importance of the nervous element in the etiology of ulcer of the duodenum. In 1922, at the Medical Congress of Florence, I had tried to call attention to the importance of this pathogenic conception from the standpoint of treatment, in which I associated the influence of the brain, sympathetic and endocrine glands in an effort to explain through the nervous system the origin of the lesion of the duodenum.

My thesis was that "the mechanism of the anatomic alteration in the duodenum through the sympathetic nervous system begins with the action of the brain on that nerve. The sudden and protracted disorder that follows causes the anatomic lesion which other observers (Nicolaysen of Christiania) believe to be due first to a submucous hemorrhage followed by auto-digestion of the mucous membrane producing tissue loss.

My proposition is that the neurotic constitution of these patients is of the greatest importance as a predisposing factor in affections in the gastroduodenal regions.

In the case of a duodenal lesion already completed, while every means should be tried for a possible cure of the ulcer, provision should be instituted to prevent its probable return, for it is well known that there is a tendency for its reproduction in the same place or in its near vicinity. For the first indication for the cure of the ulcer beside rest, atropine and opium, gastroenterostomy is to be recommended. For the second indication, the surgeon must sever the nerve connections of the stomach so that it would be free from the effects of nervous influences which may come through the sympathetic trunks.

In the present article I propose to present precise operative suggestions as to the modus operandi of freeing the affected portion of the digestive tract from the influence of sympathetic innervation.

Figure 1 shows the distribution of the sympathetic and parasympathetic fibres. The drawing represents the distribution of the two vagi with ramification of the plexus of Auerbach. There are also inserted in the drawing the ganglions of Openchowski. In the drawing the sympathetici is shown distributed along the pyloro-duodenal region according to Latarjet and Wertheimer of the school of Lyons.

There are generally six nervous elements from the hepatic plexus run-

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\* Translation by Dr. Paolo De Vecchi, New York, N. Y.

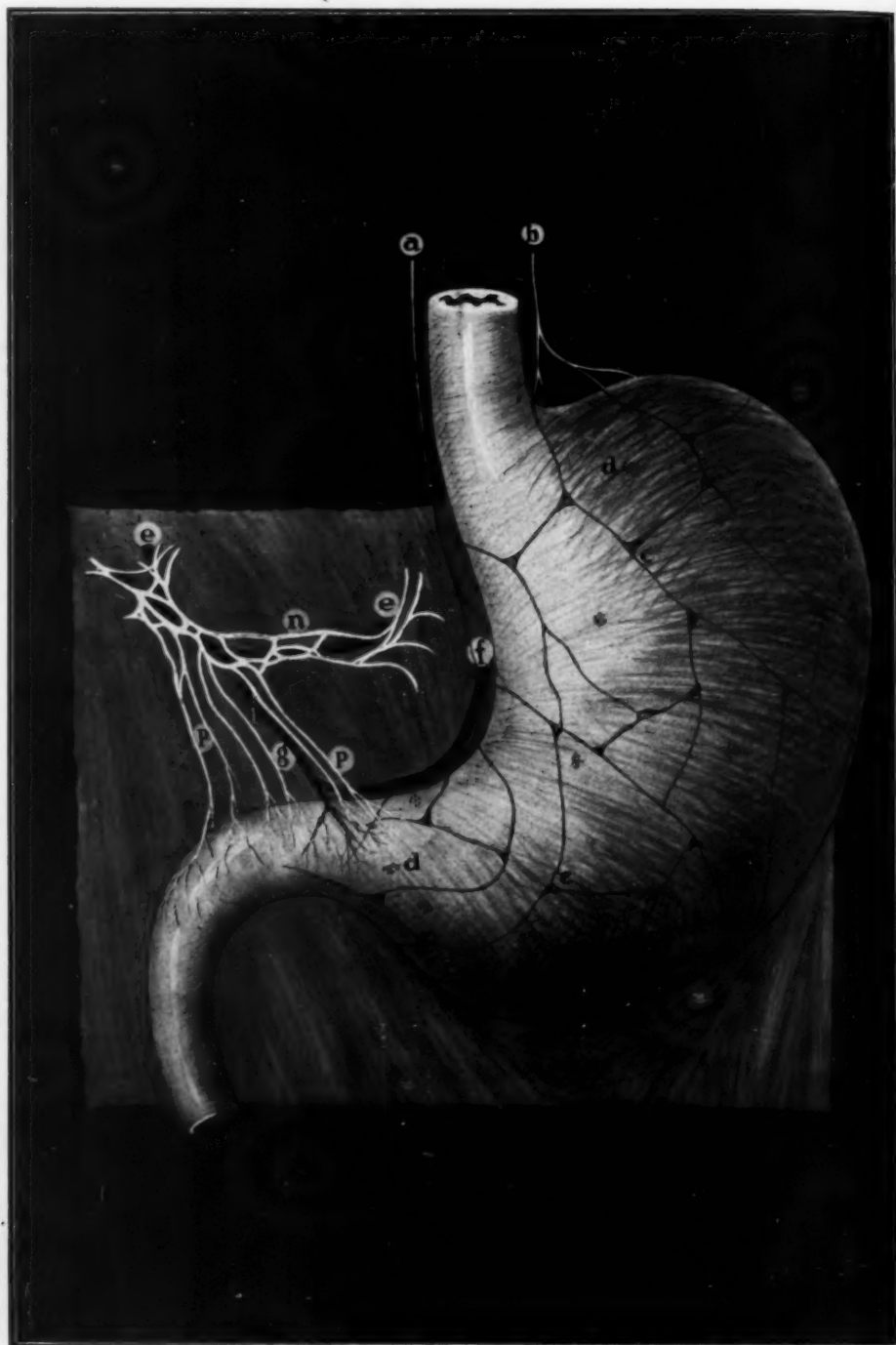


FIG. 1.—Showing the twofold innervation of the stomach, sympathetic and para-sympathetic. a, b. The vagi nerves. c, c. Plexuses of Auerbach. d, d. Ganglia of Openchowski. e, e. Hepatic artery; g, g. Pyloric artery. f. Coronary artery. n. Hepatic plexus of the sympathetic (coeliac plexus). p, p. Pyloro-duodenal sympathetic trunks (from the hepatic plexus).

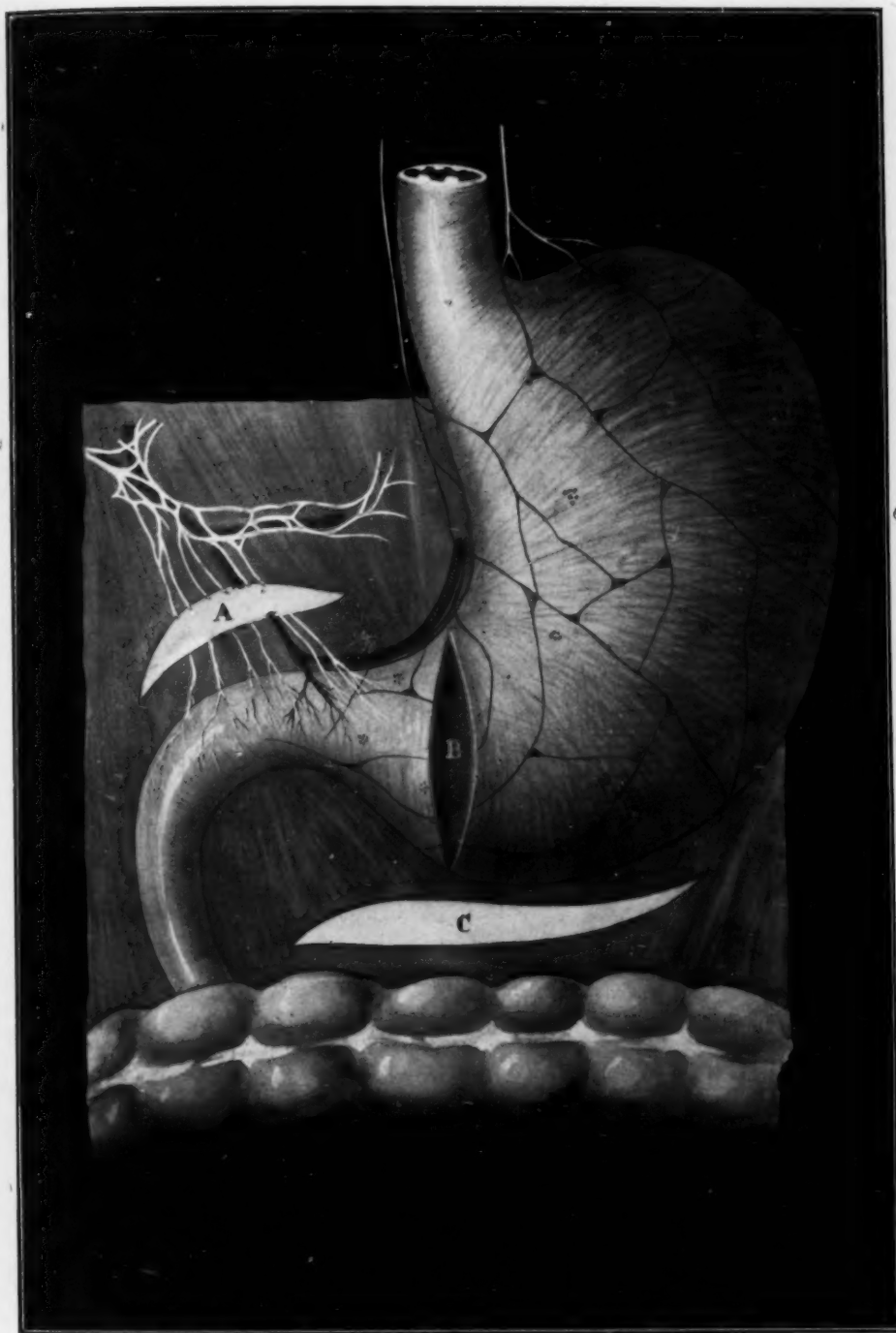


FIG. 2.—A. Incision of the gastrohepatic epiploon with resection of the pyloro-duodenal sympathetic nerves; resection and ligature of the pyloric artery. B. Resection of the para-sympathetic group of nerve fibres (intraparietal division of the vagi branches). C. Incision of the gastrocolic epiploon to give access to the posterior cavity of the epiploon.

ning to the pyloro-duodenal region, two at the left and two at the right of the pyloric artery.

In Fig. 1 the section of the sympathetic is shown as distributed along the pyloro-duodenal region according to Latarjet and Wertheimer of the school of Lyons; generally there are six nervous elements from the hepatic plexus, running toward the pyloro-duodenal region, two at the left and four at the right of the pyloric artery.

This is the operative proceeding I would advise:

*First Step.*—Incision of the epigastrium from the ensiform apophysis to an inch below the left side of the umbilicus (1).

*Second Step.*—Pulling out part of the stomach from the cavity, after examining the pyloro-duodenal region, so as to ascertain the nature and the extent of the presupposed lesion, an incision of about two inches and a half is made on the gastro-colic epiploon in correspondence with the antrum and the body of the stomach, ligating carefully the few intercurrent vessels. Through this opening the stomach is turned up so as to expose the posterior pyloro-duodenal region, with the purpose of examining and ascertaining if there are any signs of diseases in connection with the ulcer.

A large pad of gauze is introduced toward the diaphragm filling the deep retro-cavity of the epiploon (2).

*Third Step.*—With the purpose of exposing well the anterior surface of the gastro-hepatic epiploon corresponding to the pyloro-duodenal region, the stomach is pulled down toward the left, while an assistant applies a retractor under the wing of the liver, lifting up that organ.

The surgeon then, with a straight bistoury cuts the gastro-hepatic epiploon on a line which runs along the margin of the lesser curvature one-third of an inch above the margin.

By this incision the nervous elements of the sympathetic are divided with the two epiploic folds.

The pyloric artery and few small vessels are also cut and ligated in both sides, the gastro-pyloric and the hepatic (3).

*Fourth Step.*—Lifting the stomach and turning it over so as to expose the posterior surface, a vertical incision is made from the lesser to the large curvature.

The incision is made gradually, involving first the serous membrane, and then a part of the muscular tissue of the stomach, stopping at the level of the visceral wall when the wound begins to bleed freely (4).

The surgeon then, using No. 1 silk, will apply a Lembert suture rather tight and closely knotted (5).

Removing the pad of gauze from the cavity, with few stitches of interrupted suture, the gastro-colic-epiploon opening is closed.

*Fifth Step.*—On the anterior surface of the stomach, symmetrical to the posterior one, another vertical incision is made, similar to the previous (2 B.) followed by the same kind of suture (Fig. 3).

*Sixth Step.*—Lifting the transverse colon, the surgeon makes a posterior



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transmesocolic-gastro-enterostomy, which will establish a communication between the bottom of the stomach with the jejunum, the new communication being on the middle side of the vertical incision, sutured as described in the fourth step.

It is advisable to place two interrupted stitches (one each side of the anastomosis) so as to guarantee an exact position to the jejunum back of the stomach, and also to avoid a partial or total false circulation (6).

*Seventh Step.*—Suture of the abdominal wall. Dressing.

### REASONS FOR THE VARIOUS STEPS

(1) It is customary among many surgeons, when doing a simple gastro-enterostomy, to make a short epigastric cut. But in this case it is advisable to make an incision which should go beyond the umbilicus, because having to go deep into the cavity, past the gastro-hepatic epiploon, the field must be clear through a wide opening.

(2) A large and long pad must be placed deep in the cavity so as to prevent the accumulation of blood below.

(3) The alteration produced by previous inflammation may have left adhesions of the peritoneum or retractions which would make it difficult to find the nervous elements if the surgeon is not well posted on the anatomy of the region.

The nervous elements of the pyloro-duodenal tract, a derivation of the celiac plexus, emanate from the hepatic plexus, placed between the two layers of the gastro-hepatic epiploon, which are represented by six slender filaments, between which runs the pyloric artery.

In its turn the pyloric artery, arising from the hepatic, runs in the direction of the pylorus, which she feeds with few branches turning to the left in the pyloric channel along the small curvature, joining in anastomosis the coronary.

The nervous elements are usually so disposed in connection with the pyloric artery that two are located in the middle and four externally at the right. (Confirmed also by Latarjet and Wertheimer.)

In the same region, beside the pyloric, there is the right gastro-hepatic artery. But this is situated on a deeper layer and to the exterior of the zone of innervation, here spoken of, and in most of the cases is not even exposed.

With the guide of such anatomical knowledges, it is wise to follow the described technic, and in addition with the purpose of exposing better the anterior surface of the gastro-hepatic-epiploon, taking advantage of the opening made in the gastro-colic-epiploon (Second step, Fig. 2) two or three fingers can be introduced, dragging forward the gastro-hepatic-epiploon and at the same time holding the stomach down toward the left.

I suggest the bistoury in severing the gastro-hepatic-epiploon in preference to blunt instruments or scissors to avoid stretching or lacerating.

With the bistoury one will gradually cut the anterior layer of the gastro-

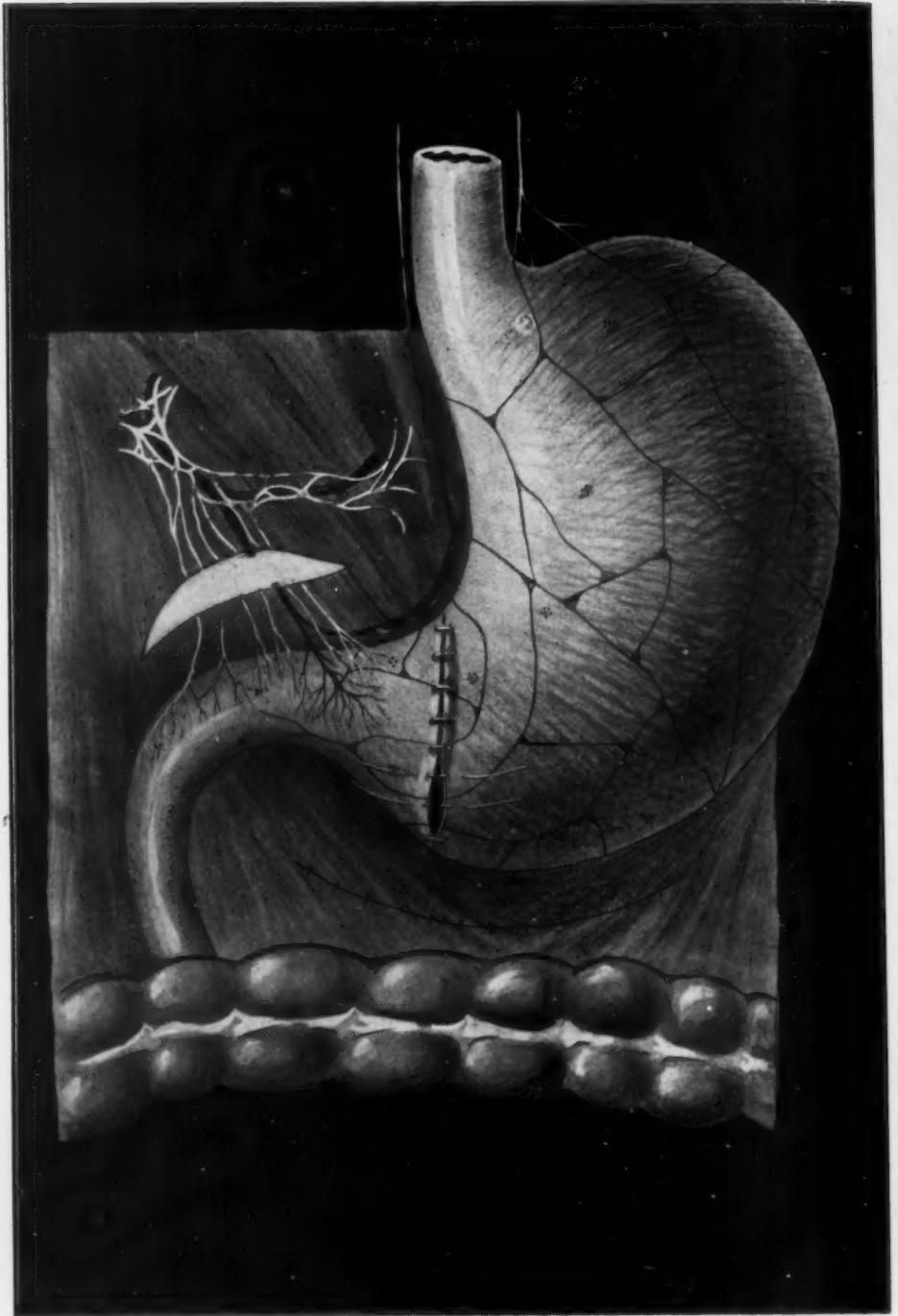


FIG. 3.—Operation nearly completed, ready for the gastro-enterostomy. The Lembert suture circumscribing the pyloric end of the stomach is about finished; the opening made through the gastrocolic epiploon has been closed by suture.

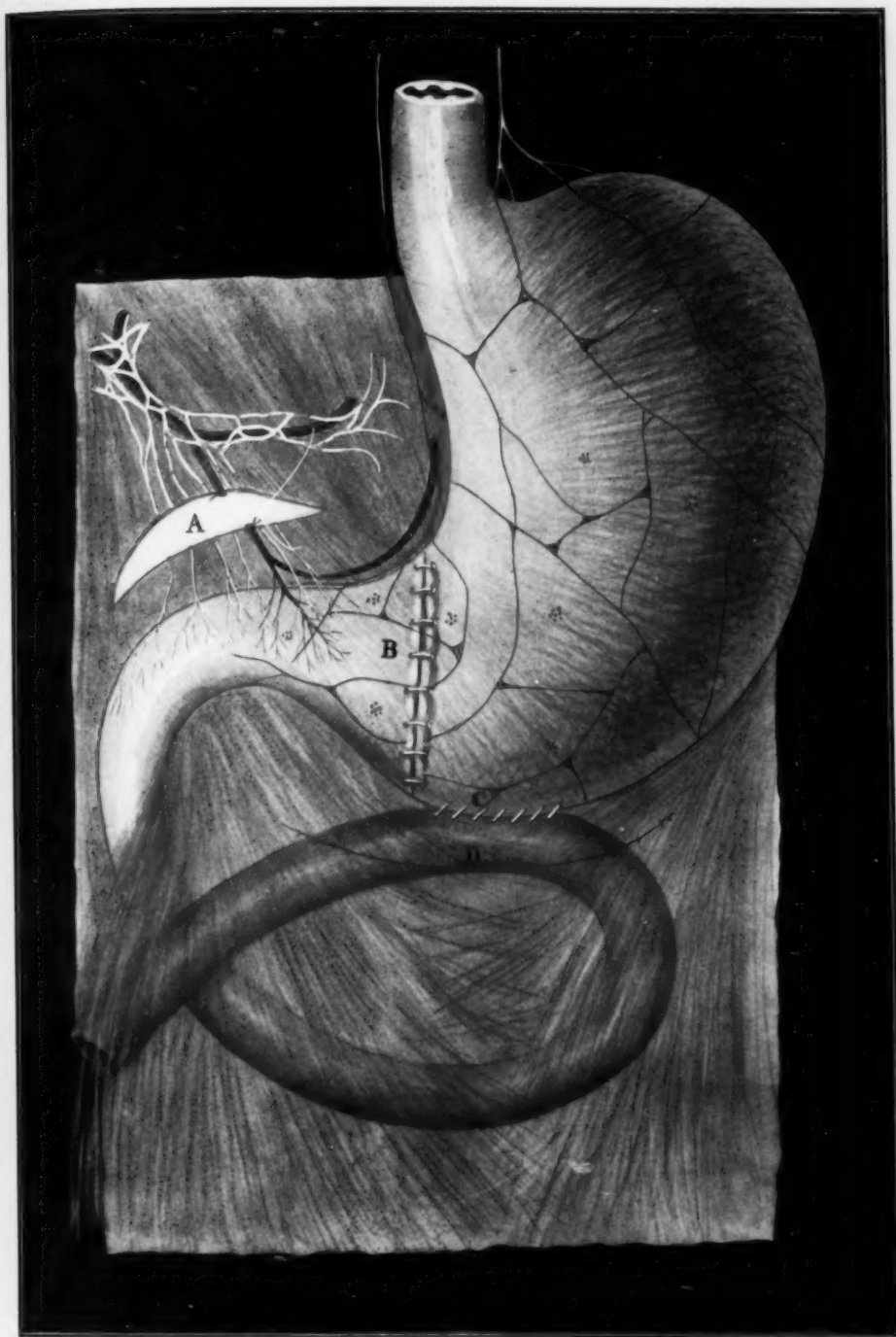


FIG. 4.—The operation completed with gastro-enterostomy. A. Division of the sympathetic group. B. Division of the para-sympathetic group. C. Gastrojejunal anastomosis. D. Suture line through the gastrocolic epiploon.

hepatic-epiploon, reaching the nervous and vascular elements and later the posterior layer.

Sometimes the special morbid conditions of the tissues would call for a modification of the technic, but the normal indication is to sever the epiploon at the level of the union of the middle third with the lower third of the stomach, proceeding toward the right as far as to reach and ligate the pyloric artery, extending the cut for about one inch more, including the posterior part of the gastro-hepatic-epiploon, as is done in the resection of the pylorus. In so doing, the head of the severed nervous elements are kept apart so as to avoid further reconstruction.

Almost every anatomist has observed that some of the nervous sympathetic filaments distributed around the pylorus are so slender that they escape identification. But as long as we know that two are placed at the left and four at the right side of the pyloric artery, in severing the epiploon to the extent of an inch each side, we can be sure of having severed also those elements even if we could not identify them.

(4) After having attended to the sympathetic innervation of the stomach, we intend to act on the para-sympathetic section, that of the vagus.

It is anatomically implied and constantly accepted that where there are blood-vessels even of the smallest dimensions there are also corresponding nerve filaments, especially in the viscera, where each vessel is followed by filaments of the sympathetic.

The physiological significance of this fact is quite important with respect to the details of the technic which we recommend. The object of the circular incision of the stomach in the region of the antrum is to sever in part and diminish the influence of the nervous elements of the two vagi which extend their filaments toward the pylorus. (Fig. 1-c.)

A deep incision is advised through the thickness of the stomach so as to sever these nervous filaments which are almost invisible, but could be inferred from the lively bleeding, in as much as we know that these filaments in their course follows the blood-vessels, we are sure that by cutting these we sever the others.

Some surgeons, severing the muscular layer, reach the mucous membrane, but we do not think this a necessary proceeding.

(5) The Lembert suture is recommended, so as to leave between the edges of the wound the sero-muscular tissue which will eventually bar the possibility of a reunion between the severed nervous ends. It is also advisable to make a very close stitched suture (*sutura a passo breve*) for hæmostatic purpose.

(6) The four subsidiary stitches which unites the entero-mesocolic loop to the stomach are of great advantage in preventing the vicious circle.

This great functional advantage in the new communication, even in the case of duodenal ulcer, must not be neglected, because the gastric contents have a tendency to drift toward the pylorus instead of drifting toward the new communication, even when the gastro-enterostomy has given an ample opening.

We must not forget that the principal scope of the operation is to give a complete rest to the pyloro-duodenal tract, leaving the stomach to empty its contents in the jejunum through the large opening made for that purpose.

*Remarks upon the Merit and Worth of the Operation Proceeding.*—The importance of this operation must be considered in respect: First.—To the simple gastro-enterostomy. Second.—To the resection of the portion of intestine affected by the ulcer. Third.—To the exclusion of the pylorus by a gastro-enterostomy.

By a general admission of the majority of surgeons the simple gastro-enterostomy does not maintain the same reputation as it did in the past, because it has happened frequently to many that the patient has returned with the same complaints from which he suffered before the operation, requesting a more radical intervention.

The second operation is considered more favorable on account of the excision of a great part of the nervous elements, in accordance with the fundamental rules set out above, for the treatment of the duodenal ulcer. But its application is not always possible on account of frequent peritoneal circum-duodenal reaction, due to the chronic duodenal ulcer, which often produces adhesions to the right toward the gall-bladder and to left toward the head of the pancreas, making the operation difficult and the final result not satisfactory.

The exclusion of the pylorus would be an efficient proceeding, providing that it included the excision of the gastro-hepatic portion which embodies the sympathetic nervous elements.

But as to this operation it is necessary to add the gastro-enterostomy, the proceeding does not seem to be advisable.

The conclusion is that the best proceeding in the treatment of the duodenal ulcer is the excision of the sympathetic and para-sympathetic nerves combined, and in cases I shall determine with gastro-enterostomy.

Is it then true that the excision of the above-mentioned nerves has such a beneficial result as above stated?

The analogical and clinical arguments are decidedly in favor of it if we consider what happens in the perforating ulcer whenever this is found.

Consider the successes due to the operation performed according to the rules of Leriche.

In cases of spasm of the pylorus treated with the method of Weber-Hamstedt, the excision of the serous and muscular membrane would correct that trouble, but Gorbandt afterward demonstrated that it was due to the excision of the nervous elements which centralizes the pyloric function.

An operation conceived by Stierlin for the treatment of the gastric ulcer, consisted in a circular incision of the stomach as high as possible, involving only the serous and the muscular membrane and tissue, suturing, immediately after, the wound.

The operation was performed twice by Steinhil without any decided result in favor of Stierlin's theory, due perhaps to the wrong selection of the patients.



But without questioning Stierlin's conception, I do not hesitate to believe that in Stierlin's idea there is a fundamental truth, which will have excellent success if applied with the rules already devised as given above.

In the last four years I have operated cases of duodenal ulcer with the excision of the sympathetic and the para-sympathetic, without the gastro-enterostomy, as I have also done the excision of the sympathetic section with the gastro-enterostomy, and finally, several patients previously operated with gastro-enterostomy suffering afterward from duodenal pains, were operated with excision of the elements of the two sections of the sympathetic.

In the three orders of cases I have proceeded with the following rules:

Opening the abdomen of patients who did not suffer serious hemorrhages and did not in consequence need an immediate rest of the pyloro-duodenum, as soon as it was found that the lesion did not cause stenosis or any deformity of the intestine, I made only the excision of the nerves of the two sections, (patients thus operated eight in number).

In those patients in whom I found deformity of pyloro-duodenal region, so as to produce a difficult evacuation of the stomach, who had also copious hemorrhages, I did, beside the above also the gastro-enterostomy, (patients thus operated fifteen in number).

In those patients upon whom a gastro-enterostomy had been already performed and in whom radioscopy showed a good function, notwithstanding the return of morbid symptoms, I made only the excision of the two sections, sympathetic and para-sympathetic, (patients thus operated three in number).

The impartial and careful observation and attention given to all those patients, and the keen interest shown by my colleagues in following with me for a long time the history and the details after the operation, has fully convinced us that this operative proceeding is the best which has been done so far in the treatment of duodenal ulcer.

## BENIGN TUMORS OF THE STOMACH

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THE infrequent occurrence of benign tumors of the stomach as compared with that of malignant growths is well recognized. Very little literature has been devoted to the former group and our knowledge concerning them, of their symptomatology and diagnostic features in particular, is scant so that a correct pre-operative diagnosis is rarely obtained. It follows that a careful study of the reported cases is essential. For the above reasons I am offering this report of a case in which the diagnosis of a benign tumor was made prior to operation, and am appending thereto a summary of the literature pertaining to this subject.

### CASE REPORT

The patient was a married woman, forty-nine years of age, whose family history was unimportant. She had been subjected to appendectomy twenty years previously, to oöphorectomy and separation of adhesions ten years before, and to abdominal hysterectomy five years before.

About one year before admission, she first noticed tarry stools. At that time she experienced no abdominal distress. Later for some months vague abdominal discomfort and a feeling of fulness had followed the ingestion of food. Three months before, during an attack of vomiting a small piece of tissue approximately one inch in diameter and resembling raw meat in appearance was noticed in the vomitus, together with bright red blood. A microscopic examination of the specimen showed the typical structure of a benign polyp, well encapsulated and with a small pedicle. No evidence of malignancy was present. (Fig. 1.)

There had been no previous hæmatemesis, no loss of weight, and the tarry stools had diminished since the vomiting of this specimen. Bowels were regular.

**LABORATORY FINDINGS.** *Blood:* Hb—80 per cent.; R. B. C.—4,700,000; W. B. C.—8,800; Differential—normal; Coagulation time—4½ minutes. *Stools:* Blood + + +. *Urine:* Normal. *Gastric analysis:* Free HCl—0; Combined HCl—6; Lactic Acid—0; Blood + + +; Bile—0. *X-ray:* Constant deformity at pylorus.

The physical examination was essentially negative, revealing a well-developed female with no evidence of loss in weight or anemia.

**Résumé.**—In view of the history of tarry stools extending over a period of one year; the lack of evidence of loss in weight, anemia or cachexia; the absence of free HCl; and an encapsulated and pedunculated specimen, the pre-operative diagnosis of a benign polyp of the stomach was made, and a gastrotomy was performed by Dr. G. W. Crile. The stomach was explored through an opening made in a bloodless area on the anterior wall. No pathological condition was discovered aside from a small hemorrhagic erosion on the mucosa in the pyloric region. This was cauterized and the opening in the stomach closed. Convalescence was uneventful and four months after operation the patient was free from symptoms.

**Review of the Literature.**—Benign tumors of the stomach were recognized and described in 1849, when Cruveilhier reported a case of polypoid tumor of the stomach. Inspired by this work, Brissand investigated the literature and extended Cruveilhier's studies and Morgagnie also reported certain cases the

diagnosis of which, however, was doubtful. A classification of polypoid tumors of the stomach which is still accepted was made by Menetrier. Individual cases were later reported by Bret, Tenneg, Friedenwald, Versi, Napp, Socca and Hayem and others, Socca and Hayem also describing polyadenomata of the stomach.

During recent years benign tumors of the stomach have been discussed by Balfour, Epstein, Tieger and Carman, but only a few additional cases have

been described, and it is on the basis of these reports that the following classification and discussion has been constructed.

*Classification of Benign Tumors of the Stomach.*—

I. Polyps. Les polyadenomas polypeux, Polyadenomas en Nappe, Brunnerian polypi. II. Lipomata. III. Osteomata. IV. Adenomata. V. Cysts. VI. Myomata. VII. Myxomata. VIII. Fibromata. IX. Lymphadenomata.

I. Polyps.—Gastric polyps may be single or multiple and vary in size from a



FIG. 1.—A, Section of benign polyp of stomach. From photomicrograph, (x 8).

diameter of one inch to several inches. Solitary growths are usually located in the pyloric region and attain larger dimensions than the multiple tumors which are usually located in the median portion of the stomach. The color naturally depends upon the degree of vascularity. When the fundi of the glands are principally involved large areas of the stomach, usually in the median portion, present numerous polyps, arranged in plaques. Cysts are seldom associated with this type of polyp and lobulation only occasionally is present. Menetrier used the term *Polyadenomata en Nappe* to designate tumors of this type.

Menetrier also described cases in which the ducts were principally involved. Cysts were frequently associated with polyps of this type and lobulation was more frequent. Since the cysts resulted from obstruction of the ducts only small areas of the stomach were involved and one or more polypoid

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growths were present on the mucous surface of the stomach. Menetrier termed these *Les Polyadenomas Polypeux*. The name of *Brunnerian polypi* was given to a third but rare type. These are recognized microscopically by the presence of glands of the duodenal type, the anlage of which are in misplaced duodenal glands.

II. *Lipomata*.—Lipomata arise in the submucous coat of the stomach and are covered with mucous membrane. They are yellow in color and are frequently lobulated, varying in size from that of a pea to that of an egg. They usually occur in the median portion of stomach and may grow toward either the mucosa or serosa. Microscopic examination shows characteristic large dilated cells containing large amounts of fat. The growth may contain lobules which are held together by a stroma of numerous fibrous strands.



FIG. 1.—B, Section of benign polyp of stomach. From photomicrograph, (x 48).

III. *Osteomata*.—Osteomata of the stomach are of rare occurrence and are usually formed by the ossification of fibromata.

IV. *Adenomata*.—The gross appearance of adenomata of the stomach is somewhat similar to that of mucous polyps. As in the latter, the color depends upon the degree of vascularity which is usually marked, and they are usually pedunculated and occur in the pyloric region of the stomach. The tumor consists of numerous large, dilated, tortuous glands with interspersed connective tissue.

V. *Cysts*.—Cysts of the stomach are usually small, although a large size may be attained. When the ducts of the glands are obstructed retention follows and small nodules are formed. Retention cysts are usually multiple, and as noted above are sometimes associated with *les polyadenomas polypeux*.

VI. *Myomata*.—In 1762, Morgagnie described the first case of myomata of the stomach. These tumors occur usually near the cardiac orifice or on the greater curvature. They are either solitary or multiple growths. In the latter case the tumors are usually of the size of a pea, round and smooth in contour, and brown in color. Single myomata may attain a very large size. Von Erlach has reported a case in which the tumor weighed 5400 gms.; Von Eiselberg has reported one of the size of a man's head; and Kunez one weighing 251 gms.

This type of tumor naturally arises in the muscular coat of the stomach and may spread toward either the serosa or the mucosa. Its growth is usually slow. Histologically these tumors are composed of interlacing bundles of unstriated muscle fibres mixed with strands of connective tissue.

VII. *Myxomata*.—Myxomata of the stomach are of rare occurrence. Hanseman has reported one case. These growths seldom attain a large size and present the characteristic features of all myxomatous growths. Myxomata arise in the muscular layer and the median portion of the stomach. On section the gelatinous, semi-transparent substance covered by mucous membrane is discernible. The tissue may be quite vascular. Microscopic examination reveals small cells with oval vesicular nuclei, the cells being held together by long protoplasmic processes.

VIII. *Fibromata*.—Fibromata of the stomach are located in the pyloric region. They vary in size and are usually pale in color as are fibroid tumors in other regions of the body. These tumors are frequently multiple, although solitary growths may be found. The shape varies from round pedunculated nodules to small flattened elevations in the stomach wall. The microscopic picture is that characteristic of all fibromata, although differentiation from scirrhus carcinoma and from sarcoma is difficult.

IX. *Lymphadenomata*.—Excessive proliferation of the lymphoid tissue of the stomach may give rise to lymphadenomata. They are found in the mucosa and are usually multiple, appearing as small nodules projecting into the stomach cavity near the cardia. These tumors are soft, smooth and creamy white in color. On microscopic examination the mucosa presents large folds infiltrated with lymphocytes, the glands being distorted.

These tumors may be associated with lymphoid tissue proliferation elsewhere, as, for example, in the tonsils.

*General Considerations*.—Benign tumors of the stomach usually occur after the age of forty, but they may occur in earlier years. As already stated, benign growths are of rare occurrence as is indicated by the following figures:

Ebstein—1864 .....	reported 14 cases in	600 autopsies.
Tilger .....	reported 14 cases in	3,500 necropsies.
Ruggles—1917 .....	reported 4 cases since	1888 (polyadenomas en Nappe).
Carman (Mayo Clinic) ...	reported 2 cases in	50,000 examinations.
Balfour (Mayo Clinic) ...	reported 1 case in	8,000 gastric lesions (polyps).
		69,000 abdominal sections.
Abbruchow Krankenhaus ...	reported 4 cases in	7,500 necropsies (polyps).



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Among the *etiological factors* cited in the literature are (1) syphilis, (2) atheroma of vessels, (3) chronic gastritis, (4) chronic gastric catarrh. Aschoff, however, states that gastric catarrh is secondary to polyposus.

A benign tumor may be present without giving rise to any symptoms and be found only at autopsy. As would be expected, the diversity of symptoms would depend upon the size, vascularity and the location of the growth. Pedunculated tumors in the pyloric region may prolapse into the pylorus and produce the symptoms of pyloric obstruction, pain, vomiting and retention. The prolapsed tumor usually falls back later and a quiescent period ensues. Dyspepsia, nausea and belching, with considerable abdominal discomfort, may exist for a long period of time. Hemorrhage is not a constant symptom, but occurs more frequently in cases of polyps and of adenomata on account of their vascularity. Achylia is frequently present. Myers calls attention to the diagnostic significance of the vomitus, stating that in cases of benign tumors it usually contains a large amount of mucus and resembles egg albumen. The large tumors may cause a sense of weight and fulness in the epigastrium.

As there is nothing really pathognomonic in the symptomatology the diagnosis of a benign tumor is rarely made before operation, although in the case reported by Myers, and in our own case in which the polyp was vomited up, the diagnosis was easily made. However, in gastric cases which do not present the typical symptoms of other well-known lesions and are accompanied by the type of vomitus mentioned, hemorrhage and achylia, suspicion should be aroused that a benign tumor may be present.

The röntgenogram is of little aid in the diagnosis. In cases of polyposis, it may show a diffuse mottling or honeycombed appearance of the stomach due to displacement of the barium by the masses of polyps, but other benign lesions of the stomach present no typical picture. Carman states that experience in the X-ray identification of benign tumors of the stomach is still meagre due to the lack of reported cases.

Malignant changes may occur in adenomata and in gastric polyps but are not common (Menetrier and Clunel). If the presence of a benign tumor is suspected the indicated treatment is an exploratory operation and removal of the involved portion of the stomach. Pedunculated growths may be excised and the base cauterized.

The prognosis is favorable unless the involvement is extensive, being especially good in cases of pedunculated growths.

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## GALL-STONES AND DISEASES OF THE GALL-BLADDER\*

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THE gall-bladder has with new knowledge come to a position of increasing importance. Years ago when diagnosis was less accurate the term neuralgia of the stomach, other than syphilitic, obscured many a gall-bladder colic. The disease was explained by the humoral theory, or by diathesis, such as an inheritance of a bilious state. Later came better diagnosis of diseases of the gall-bladder in the presence of gall-stones, and when the bacterial theories of these diseases were developed and proved by experimental research the subject seemed to be almost settled. The infection theories were well supported by Naunyn, Rosenow and many others. Now we are back to a modified humoral theory and believe that changes in blood constituents antedate the infections and prepare the way for them by disturbing liver function and thus lowering the resistance of both tissue and body fluid. The present opinion, following failure to relieve gall-bladder disease by the so-called medical drainage of Lyon, and the growing conviction of an associated defect of hepatic function, will probably place many patients, during the incipient stages, in the medical category for treatment, or at least for pre-operative and post-operative observation and treatment. It is necessary that we obtain more knowledge of the relation of deranged hepatic function to gall-stones and other diseases of the gall-bladder. This should be available when the results of diagnostic methods, medical and surgical treatment, and necropsy investigations are assembled, and all manifestations of disease grouped into one picture. Of the salient points to be considered by those in charge of such patients, the first is the structure of the gall-bladder. It is a sac with a capacity of 0.75 to 1.5 ounces connected with the delivering bile duct, and is developed from the same mass of cells as the stomach, duodenum, pancreas and ducts. It may lie deeply buried in the liver, in some cases even lifting liver tissue free upon it, or it may rarely be so loosely attached as to have a mesentery. Four layers make its structure: the mucous, the muscular, the elastic, and the serous. Bile drawn from the gall-bladder is approximately ten times as concentrated as that in the hepatic ducts secreted by the liver. The gall-bladder not only concentrates bile, but at the same time adds mucus. Observation of Lyon's duodenal drainage disproves the contention that bile which enters the gall-bladder does not return through the cystic duct, although much less goes out than enters through the cystic duct. The relief obtained by Lyon's drainage with magnesia passed into the upper small gut without contact with gastric secretions is found to cause temporary relaxation to the sphincter of Oddi. It is probable that but a small amount of the total bile enters the gall-bladder. These investigations show why cholecystoduodenostomy fistulas performed for the relief of

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jaundice in pancreatic obstruction of the duct, close, with recurrence of jaundice, if normal common duct delivery is temporarily reëstablished.

The gall-bladder is sometimes difficult to empty by pressure at operation, and sometimes easy. It is difficult to determine whether stones of small size and few in number are present in a well-filled gall-bladder, but fairly easy if it is partially emptied of bile. Mann has placed a canula in the gall-bladder and another in the common duct, and shown by pressure gauges that the gall-bladder undergoes contraction, with increase of fluid tension, without change in the pressure of the common duct. The rich lymphatic supply of the gall-bladder, extending for an inch or two on the liver, is probably the means of absorption of the fluids of bile concentration filtered during these contractions, which when present last for some seconds and occur from one to five times each minute. Infection with certain streptococci which have a selective affinity for the gall-bladder was found in the wall of the gall-bladder by Rosenow. Injected in quantity into the blood of animals, these streptococci produce gall-bladder disease in a high percentage of cases.

Mann's investigations showed that certain hypochlorites have a chemical affinity for the gall-bladder. Without infection they produce chemical inflammation and round-cell infiltration, similar to that brought about chemically by toxins; but developed within a brief period of minutes following intravenous injection. Repeated injections at intervals cause marked destruction of the gall-bladder mucosa and structural changes. Almost every degree of change in the gall-bladder is seen as a result of disease in it; it may be thin-walled, blue, free from adhesions and contain one almost pure cholesterin stone. Rarely the condition is seen with multiple stones in which besides cholesterin there is considerable calcium. A gall-bladder with marked fatty changes in its wall is clinically not normal. There are usually some adhesions, and they occasionally completely cover the gall-bladder. With or without stones, adhesion of the gall-bladder to omentum or duodenum or colon, is usually caused by gall-bladder disease, and not the reverse. However, with chronic perforating ulcer of the duodenum, adhesions to the gall-bladder may be found. Cholecystitis is now considered the essential and primary disease, gall-stones being secondary to certain forms of cholecystitis and not found in all types or dependent on the degree of inflammation. The basis is broader than that, however, since all such changes must now be considered in relation to hepatic function; in fact they constitute a group disease.

Gall-stones are found in approximately 70 per cent. of all cases of gall-bladder disease. Strawberry gall-bladder, papillary gall-bladder, and inflammatory gall-bladder, with mucus and thickened bile to excess, without stones, make up the remaining 30 per cent. of cases.

With cholecystitis there are definite reflex symptoms referred to the stomach at fairly definite periods, usually within thirty minutes after eating, with marked qualitative food dyspepsia caused by retention of gas-producing, and greasy foods in the stomach constituting so-called indigestion with pylorospasm. Less severe pain and more prolonged soreness after spells aid

the diagnostician since it is probable that stones are either not present or are too large to obstruct the duct. The tenderness is due to a local peritonitis on an inflamed gall-bladder overstretched by spasm of the sphincter of Oddi. With single cholesterol stones, and sometimes with multiple stones, there are few or no symptoms of cholecystitis; those of acute obstruction of the duct by stone occur without reference to meal periods, often in the night, and no soreness or discomfort remains the day after the attack. By palpation at operation the sentinel glands which indicate infection are found to be enlarged in proportion to the nature and amount of infection present. Nature has placed one gland, or two at the most, on each of the ducts, draining a rich lymphatic area. In health they are of a definite size, and in disease they are enlarged.

Primary cancer of the liver usually begins in the gall-bladder or ducts, around an impacted or nearly fixed stone, two to six years after gall-stone attacks have ceased, and may be suspected in a patient with a painless jaundice and a previous history of gall-stone colic.

The appearance of the liver is significant. If the gall-bladder and ducts are diseased, the liver is darker and rougher, and the acute angle, or axe edge, has largely or completely disappeared. With greater degrees of gall-bladder infiltration there are developed local cirrhotic areas usually shown by white lines radiating out on the surface of the liver from the attachment of the gall-bladder, outlining the spreading lymphatic area from gall-bladder to liver. The liver is, as a rule, more solid and fixed in its position; adhesions to the omentum may be formed around the liver in the gall-bladder area; its superior surface may be adherent to the parietal peritoneum. Undoubtedly the liver must be considered as primarily involved in many cases in which only a diseased gall-bladder or the presence of gall-stones has heretofore been recognized.

The liver secretes about an ounce of bile an hour when functioning; between digestive periods the gall-bladder is concentrating bile. Bile in the intestines is necessary for health, yet life may go on for long periods with total obstruction from benign causes. If the common duct of a dog is ligated under anæsthesia and aseptic precautions, jaundice will not develop for three or four days, the gall-bladder filtering out the fluids from the bile and bringing about a higher degree of concentration. The blood may show no change due to bile salts for twenty-four to thirty-six hours. If the gall-bladder is removed under similar conditions, jaundice appears in twenty-four hours and bile salts appear in the blood in three. If the common duct is obstructed near its outlet, jaundice is slow to appear and then deepens, the colloidal mucus continues to form under the full blood-pressure of the cystic artery while the liver, working sluggishly against a handicap, will secrete less and deliver less. Bile fluid is filtered through the gall-bladder wall into the lymphatic drainage, and primarily its salts concentrated in the gall-bladder, and the colloidal mucus from its wall, often called white bile, gradually fills the distended gall-bladder and ducts. In the intermediate period between early and late symptoms thick green granular-looking bile is present, but all is later



dissolved and re-absorbed or replaced by the white bile. Sweet has demonstrated minute saccules along the hepatic ducts and radicals, which are possibly more numerous in the animals which do not have a gall-bladder, and which probably do some of the work attributed to the gall-bladder. The sphincter of Oddi, encircling the common duct outlet, maintains the tension of the duct and is probably concerned in mechanically enabling a part of the total bile to pass into the gall-bladder for concentration. It therefore assists in cholesterol accumulation.

Cholesterol is found in many places besides the bile, but the places of its manufacture are not all known. The suprarenals are concerned and the corpora lutea of the ovaries. The liver tissue contains it and secretes it. It is classed as an alcohol, is soluble in bile and in fat, and is precipitated by water. Cholesterol forms 25 to 30 per cent. of the blood fat and lipoids. According to Michaud it presents a very constant distribution between cells and plasma, the percentage in the cells being 45.5, and in the serum 54.5. Bile contains fat, cholesterol, bile salts, and also bilirubin, which is probably not formed in any quantity by the liver, but is withdrawn from the blood by it. The calcium is held as calcium bilirubinate and calcium carbonate. Michaud shows that the fats and cholesterol are held in emulsion by the soaps and cholates which diminish surface tensions as emulsion colloids.

Changes in these protective colloids by an excess of albumin, fats, or by bacterial toxins may cause abrupt precipitation and stone formation (probably slightly slower than the formation of an egg shell) from the bile mixture of crystalloids and colloids. Many small stones formed one at a time often adhere to form a mulberry stone.

A small percentage of gall-stones are in concentric layers enlarged by accretion, when those conditions obtain which would cause the formation of a stone in others. Rarely two colors of gall-stones, light and dark yellow, may be found in the same gall-bladder from a change in bile salts. The difference in density of the stones, some being easily crushed and others being quite hard, is explained by the ages of the different stones and by their periodic development.

Hepatic duct stones are composed of bile salts, bilirubin or carbonate of lime, and naturally less cholesterol. They are irregular in shape and dark brown or black.

Rowntree, in 1914, while working on phenolsulphonephthalein tests of the functional capacity of the kidney and liver, showed that the phenolsulphonephthalein was eliminated by the kidney and the phenoltetrachlorophthalein by the liver. Three years ago Rowntree discussed dyes as making possible through their elimination röntgenologic studies of the delivering tracts when given by mouth, and when injected for studying the genito-urinary tract he used these dyes. This was developed later by Graham with the tetrabromophthalein for examination of the gall-bladder röntgenologically, and later studies indicate that the iodophthalein may prove even better for the purpose. Rosenthal has still further carried on the Rowntree functional liver tests.

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Bacmeister describes the two types of stone formation, infectious and non-infectious, forming in addition, combinations with lime. Michaud describes the results of inflammatory production, from colon or typhoid bacilli, of fibrin and albumin which increases the calcium and leads to precipitation. Cholesterol in excess, soluble in cholates, may be precipitated by an excess of blood fat.

Cholesterol is increased in blood temporarily by excess of fat in food. There is this excess in pregnancy. Nearly 80 per cent. of the gall-bladder diseases now recognized occur in women. Approximately 80 per cent. of these have borne children, and had the first attack at the period of pregnancy or soon after childbirth. The primary disease is undoubtedly metabolic and involves the liver as well, and may all be of a temporary nature. The secondary disease, formerly called gall-stones, is in the gall-bladder or is induced by some affection of it. The gall-bladder should be removed to eradicate the disease, unless there are such complications as acuteness of attack, the seriousness of the illness, acute pancreatitis, and other organic disturbances. If the gall-bladder looks normal and contains a single pure cholesterin stone, or if the patients are of advanced age, cholecystostomy with drainage may be substituted. It is not as effective as cholecystectomy, as it does not relax the sphincter of Oddi.

The condition of the pancreas should always be recorded at the time of operation, as pancreatic inflammation is usually secondary to disease of the liver, gall-bladder and bile ducts. It may recur months after operation, with pancreatic colic, and pain in the back, not unlike the original attack.

Stone caught in the cystic duct causes recurring attacks of colic at short intervals for a period. Later infection with another type of bacteria produces empyema, while contraction and thickening of the gall-bladder wall slowly move the stone into the common duct. We usually determine the necessity and the function of an organ or tissue by observation of individuals or animals in whom nature has destroyed it, or the surgeon or the research investigator has removed it. Although I have not noticed any apparent defective function traceable to its absence, I still believe the gall-bladder is in part a true gland which long ago, like the tonsils, might have had an important function in protecting the body against certain foods or toxins, and is probably not so important at this time. It is apparently a filter of concentrated bile, the filtered fluids passing to the blood stream through the lymphatics. Those animals which live off the soil have, with few exceptions, a gall-bladder. The pocket gopher living and feeding beneath the soil has none. The striped gopher, living beneath and feeding above the soil has one. Most of the leaf eaters, which include those animals which shed their antlers yearly, do not have a gall-bladder.

It is probable that the increase in our digestive diseases is due to more rapid changes in our food and methods of its preparation than the slower working evolutionary processes can as yet become adjusted to.

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## SURGERY OF THE GALL-BLADDER AND DUCTS\*

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IN SPITE of the many laboratory and technical procedures which aid the clinician in the diagnosis of disease, it is still true that our main reliance in the diagnosis of gall-bladder disease rests almost entirely on an inquisition of the patient, physical signs being present in the acute attacks only. The X-ray gives valuable negative evidence and sometimes positive evidence, but chiefly in advanced cases where it is least needed. After diligent questioning regarding indigestion and acute, painful attacks, one arrives at a correct diagnosis in a large percentage of cases. This is the more remarkable when we remember that most people observe inaccurately, have confused memories and a limited use of spoken language. One carefully avoids all leading questions. One seeks to find whether the patient's diagnosis of "indigestion" means anything more than a feeling of fulness after moderate eating. As to the acute attacks, one inquires into the severity of the pain, its first location, its radiation, abruptness of onset and cessation, its character and the posture assumed during the attack. We inquire also regarding the presence of associated symptoms. If an operator is thoroughly familiar with the details of a patient's history, the number of operations undertaken as explorations will be quite small. This is important as the signs of disease of the gall-bladder may not be very definite before its removal and, on an unimpeachable gall-bladder history, we may at times remove the gall-bladder in the absence of gross signs of disease.

These signs are adhesions (not mistaking anatomical bands), thickening of the wall (as shown by palpation) and change of color. Aspiration may be employed to show whether the content is unusually dark and viscid. Large lymph-nodes about the cystic duct may attract attention. In time we may learn to rely, too, on a hepatitis circumscribed to the vicinity of the gall-bladder. Whatever it may do to the patient, it will not improve us as surgeons or our knowledge of disease, if we explore without a thorough knowledge of the history and remove several structures in the hope that one or the other was responsible for the symptom complex.

Gall-bladder lesions and stones are encountered with surprising frequency in operations undertaken for pelvic disease. Subsequent inquiry may show that the patient's attention has been focused on a conspicuous pelvic tumor but that the symptoms are more likely dependent on the gall-bladder region. It is not going too far to say that in laparotomies, the palpation of the upper abdomen should rarely be omitted, the chief contra-indication being spreading types of infection. It is preferable to palpate the upper abdomen at the beginning rather than at the end of the operation if that is feasible. The

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result of the palpation, whether positive or negative, should be recorded on the history and the patient or friends told of the finding. It requires carefulness and some training not to overlook small stones in palpating. I have found them a number of times at operation in persons recently operated on by incision over the gall-bladder and told their trouble was appendicitis.

No fixed rules can be made to guide one when a diseased gall-bladder is found at the end of a laparotomy. Sometimes we proceed with the removal and at other times the offending organ is reserved for subsequent operation. The decision will depend on such factors as length of operation, location and size of incision, patient's general condition and the operator's dexterity. I once left gall-stones in a case of acute appendicitis and have been waiting for five years for a second call to the patient. My conviction, based on a few disagreeable experiences, is that one should postpone the gall-bladder operation, or do it as well as he would, were it the only operation to be done on the patient. Never attempt a hurried operation through a small incision with a cholecystostomy when a cholecystectomy is indicated.

Three theories of the origin of gall-stones claim attention. 1. The stasis theory is a little hard to comprehend. The concentration of bile to a fraction of the amount secreted seems to be the function of the normal gall-bladder. It is never found empty in the living or dead. Adhesions of it to nearby structures need not impair its activity. A type of stasis then, seems to be the normal condition. Its advocates find the cause of stasis in congenital abnormalities of the bladder or ducts rather than in posture, ptosis or the pressure of belts or corsets. Doctor Elliot Smith finds gall-stones totally absent from the bodies of early Egyptians. This would hardly be the case were slight anomalies the sole cause of stone formation. Stasis had better be thought of as a contributing cause.

2. The metabolic theory. This seeks to assign to a hypercholesterinæmia the essential rôle in stone formation. The typical stone of this variety is, according to Aschoff,<sup>1</sup> always single and has a radial, crystalline structure. It may later become coated with other materials and be followed by secondary stones of other kinds. He says he has never found but one stone of this type in a gall-bladder the seat of multiple stones. Chauffard<sup>2</sup> says these nuclei give no reaction for protein or anything to indicate an inflammatory origin.

3. The infectious theory. Infection has gained most credence among surgeons. As a theory it is held with numerous modifications and combinations with other theories. The old theory of Naunyn attributes them to stasis in the bile ducts to which is added a mild catarrhal infection with resulting increase of cholesterin in the bile. According to Aschoff,<sup>1</sup> the finding of bacteria in the bile without inflammation is evidence that "excretion of bacteria through the liver runs its course without special reaction." Since the discovery of typhoid carriers and bacilli in gall-stones, the subject of the relation of typhoid to cholecystitis has been a matter of interest. Chauffard<sup>2</sup> is impressed with the infrequency with which persons require operations for



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gall-stones in any reasonable time after an attack of typhoid fever. Blalock<sup>3</sup> reports that 28 per cent. of the Johns Hopkins cases gave a history of typhoid, the highest percentage being in the cases without stone. It is doubtful whether we could obtain a typhoid history in 5 per cent. of cases in New York. Typhoid or paratyphoid has been found in six of my operative cases. Only two of them, however, knew of having had the disease. In these two, the gall-stone history began more than twenty years after the typhoid and the stones were few and small. All six cases had stones in addition to a gall-bladder disease.

The relation of liver and gall-bladder inflammations to other abdominal disease is demanding a good deal of attention at the present day. The association of gall-bladder disease with pelvic diseases in women has been alluded to. There seems, however, to be no reason to consider this other than a

coincidence as fibroids most commonly require attention in the fourth decade and gall-bladder disease occurs at about the same time of life. One sees every type of appendix—normal, inflamed and atrophic—with cholecystitis. Whether the diseased ones are more frequent in people with gall-stones than in the common run of the population of about the gall-stone age, is difficult to say.

One association, namely that of gall-stones and duodenal ulcer, has seemed too frequent in my cases to be a coincidence. Among ninety consecutive cases of gastric ulcer and cancer, ten had gall-stones. This becomes the more significant when we remember that ulcers more commonly affect males and gall-stones are more frequent in females in the proportion of four to one. (See Figs. 1 and 2.)



FIG. 1.—Gall-stone complicating duodenal ulcer, previous to taking bismuth meal.

A number of incisions have been recommended for gall-bladder work. We can make one generalization, namely, that they are all more difficult to make and close than the simple, vertical, right rectus incision made near the outer margin of the rectus. Practically all of the cases in this series have been handled through this incision. Occasionally, if the incision is badly placed for drainage, it has been closed and a drain inserted through a stab wound.

Not a half dozen simple gall-bladders have been closed without some



FIG. 2.—After taking bismuth meal.

form of drainage. That many cases can be handled without drainage, there is abundant evidence; but in the mild cases where one would consider closure, a small, folded rubber dam drain does no harm, does not delay ultimate healing, does not produce hernia, and is of decided advantage if there should be considerable oozing and much bile discharge either from the liver surface or from the cystic

duct. In case of an overlooked obstruction in the common duct, it would be highly desirable. It is my impression that a folded rubber drain left in the bed of the gall-bladder and isolated by suture and left only for three or four days, is not a factor in the production of symptom-producing adhesions. Such adhesions result from prolonged bile or pus drainage in the type of cases where closure would not be considered.

There is considerable difference of opinion as to the advisability of immediate or postponed operation in acute gall-bladder disease. We have no hard and fast rule, but have not considered the acute gall-bladder operation as urgently indicated as the acute appendix one. On the other hand, very much time is consumed and nothing in particular gained in a long delay while waiting for

the acute attack to entirely subside. Reference to my own cases shows that these are not the patients that succumb to operation. The acute hydrops, empyema of the gall-bladder and perforated gall-bladder with adjacent abscess, usually have a very smooth convalescence, and the decline of temperature is hastened by operation. Few patients die from cholecystectomy who are under fifty years of age. The deaths are largely the result of associated visceral disease, advanced years, and common duct obstruction and infection, and not suppurative or gangrenous cholecystitis.

Cholecystectomy as the operation of choice seems to have come to stay. The arguments in its favor have been so much dwelt upon that they need not be here recounted. I find myself among the most radical, doing more than twenty-five cholecystectomies to one cholecystostomy. Formerly it was considered that cholecystectomy would give the larger mortality. Now quite the reverse seems to be the case. We might say that either drainage or removal of the gall-bladder have no mortality of themselves, that the mortality is dependent on such factors as anæsthetic, complications like pneumonia, associated lesions such as pancreatitis and visceral changes. Not all operators have been converted to this way of thinking. Cullen<sup>4</sup> reports 296 operations with only 6 cholecystectomies. These were done because of suspected malignancy. In the conclusion of his paper it is suggested that the mortality would have been higher with cholecystectomy. He reports a mortality in his cases of 10 per cent., whereas cholecystectomy mortality as reported by others is 1 to 5 per cent. McGuire<sup>5</sup> recently reported a thousand gall-bladder cases operated on over a period of twenty years in which there were only 37 per cent. of cholecystectomies, but he states that the percentage of cholecystectomies has increased so that in recent years practically all operations are cholecystectomies. In Clark's<sup>6</sup> earlier series, the cholecystostomies were twice as numerous as the cholecystectomies. In the recent series the cholecystectomies were twice as numerous as the cholecystostomies. In this recent series, the mortality of cholecystectomy was 4 and 6/10 per cent., while the mortality from cholecystostomy was but 1 and 9/10 per cent. This would seem to show that cholecystostomy had not been reserved for his more difficult cases. Clark<sup>6</sup> speaks well of the so-called "ideal" operation, which means opening the gall-bladder, removal of the stone and closure of the gall-bladder. It is hard to understand the selection of this operation unless all the gall-bladders requiring operation contain stones. Even then, it is difficult to see a reason for employing it unless one were convinced that the stone was primary and the cholecystitis secondary. I have never done the operation and would suggest some other name for it than "ideal." I have never regretted the selection of cholecystectomy, but several times have regretted doing a cholecystostomy.

In the preparation of this paper, I have collected statistics not going back of 1916. Among them 250 consecutive cholecystectomies for stone or cholecystitis have been done with a mortality of five, the deaths being from œdema of the lung, myocarditis, strangulated hernia, uræmia and sepsis. Only one has died within a week of the operation. This gives a mortality of 2 per

cent. During the same time there have been ten cholecystostomies with two deaths. One was a drainage of the gall-bladder in acute pancreatitis without stones. Another was a drainage in septic cholangitis. Among the eight survivors, three required operations at a later date. In two cases, stones were overlooked, and in one they re-formed in the gall-bladder and common duct. In several of these, the cholecystectomy was done at the end of an operation for other troubles. Only two cholecystostomies have been done in the last five years. Among the 250 cholecystectomies, six required re-operation. Of these, three were for common duct stone, in one the cystic duct dilated and seemed to be the cause of symptoms, and another had recurrent attacks of apparently typical biliary colic for which no cause could be found.

If a cholecystostomy is to be done, it is wise to invert the gall-bladder around a tube and remove the tube as early as possible. The gall-bladder should never be sutured to any layer of the abdominal wall. Re-operations are required, first for persistent fistulae, second for stones overlooked, and third, for pain, either constant or in acute attacks. I have operated on a number of patients for persistent sinus, in one of whom the gall-bladder had been sutured to the skin. Others have been found firmly adherent to the inner side of the abdominal wall. In some of these there have been acute attacks of pain resembling biliary colic and yet no stone has been found at a subsequent operation. It is possible that these cases would interest those who believe in the stasis theory of biliary colic and gall-stones. When the fundus is attached to the abdominal wall, it becomes the most fixed part of the viscus and on filling, the deeper part is thrust inward, causing angulation of cystic duct or ampulla. At any rate, the removal of the gall-bladder has resulted in the cure of the colics in these non-calculus cases.

In doing a cholecystectomy, it has been my practice to leave a large part of its peritoneal investment. As a rule the dissection has been carried to just beyond the ampulla, enough of the cystic being enucleated to allow the application of a ligature. The peritoneum is then allowed to drop back into place and occasionally a few sutures close the peritoneum over a rubber dam drain placed in the gall-bladder bed. It facilitates the safe removal of the gall-bladder in many instances to split the outer leaf of the gall-bladder investment well down toward the cystic and then roll the gall-bladder toward the median line. The operations here recorded as cholecystectomies have not always been complete and I believe no one should attempt a cholecystectomy who is not willing under some circumstances to do a partial cholecystectomy or cholecystostomy. The shrunken gall-bladder of a common duct case need only have the portions not attached to the liver removed in order to affect a cure.

In operations on acute gall-bladders, especially with stone impacted in the ampulla and with extensive inflammatory changes or gangrene about the stone, it is simpler and safer to amputate through the ampulla and to put a tube in the ampulla than to attempt to remove it and ligate the cystic duct.

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Whether to ligate the cystic duct or to leave it open for drainage is decided on the merits of the individual case. Very often the ligature is omitted because it is easier. There is some advantage as regards wound healing if one can make the bile drain through a tube and keep the wound dry rather than have bile discharge around a drain, keeping the surface of the wound moist and possibly infiltrating between the layers of the abdominal wall.

Internal fistulae are occasionally encountered between the gall-bladder and duodenum or other viscera. They make the dissection more difficult and make one dread a complicating duodenal fistula. The fistula in my cases has always been small and has been closed with ease and never has resulted in leakage of the duodenal contents. The internal fistula may have been large at first, as is attested by the passage of stones large enough to cause obstruction in some cases, but after passage of the stones, the opening contracts as one would expect. Abscesses, too, between the gall-bladder and adjacent viscera have added to the difficulties of the operation, but have not made the convalescence more protracted or tempestuous. A number of cholecystectomies and one duct reconstruction have been done during pregnancy, at various times from the second to the ninth month. In no case has an abortion followed.

In the surgery of the common duct, the mortality is roughly four times as high as that of the simple gall-bladder. In a series of seventy-one cases, I have had nine deaths. This gives a mortality of 12 and 6/10 per cent. A number of surgeons put the legitimate mortality at about 10 per cent. In addition to the usual deaths resulting from a combination of old age, visceral disease and jaundice, several of the deaths have been the result of hemorrhages. At present we administer calcium chloride before operation in the jaundiced cases and in the last few years, transfusion has been done before or at the end of the operation where hemorrhage was to be expected. Other methods such as the giving of blood serum, whether of the horse or human serum, may be employed in emergency, but our sheet anchor is the transfusion of human blood. Bleeding usually stops when a few syringefuls of blood have been given. In a recent case where hemorrhage might have been expected but did not occur, a donor was obtained and kept in the hospital or on the 'phone for five days. One patient had had a large block of the common and hepatic duct removed at a previous operation. After eight months, bile drainage ceased, to be followed by jaundice. At operation nothing was attempted but the insertion of a small drain in a punctured wound in the hepatic duct. Bile drained at first copiously, later in less amounts, becoming bloody and finally entirely blood. This patient was transfused three times and died during the last transfusion, about the fourteenth day post-operative.

It has seemed remarkable to me that when a segment of a duct has been removed that a fistula would not persist indefinitely, but experience has shown, as in the above case, that the duct finally closes and jaundice supervenes. If this is allowed to occur, the operation of opening the duct and drainage is a very serious matter. Opening the duct may or may not be technically difficult,



but apparently the effect on the liver is much like that of sudden relief of back pressure on the kidney. The liver tissue, suddenly relieved from pressure, becomes incompetent and suppression of bile and cholaemia supervene. In the ordinary common duct stone cases when drainage is established, one often sees jaundice increase in the first few days after operation, even though bile is continuously draining through the tube. It has been my assumption that portions of liver tissue swell up about the ultimate radicals of the bile ducts and thus for a time do not contribute to the bile flow.

In the typical common duct case, the relief of the common duct obstruction is the matter of first importance and the removal of vesical stones or gall-bladder is distinctly secondary. It is often the part of wisdom to begin the operation by attacking the common duct first and when the main indication has been met, remove the stones and gall-bladder, in whole or in part, if time and the patient's condition will permit. The operation of transduodenal choledochotomy, devised by McBurney, is a good operation, but by no means always easy. I find that I have employed it less frequently as time has gone on, and it is my impression now that in some of the early operations it was not necessary.

During the last year, two patients were operated upon for what seemed typical attacks of colic. Neither, however, developed jaundice with an attack. In one, cholecystectomy had been done by me for stone; the other had been twice operated upon, first by drainage and, second, by cholecystectomy. I saw both patients in attacks and they were also seen by others, but the absence of jaundice put me on my guard. Each was examined and sent home from the hospital after several days' observation only to return some weeks or months later because of continuance of attacks. At operation, no obstruction was found in the common duct, though it was opened and probed, nor was there any thickening or conspicuous dilation of the duct.

No explanation for the attacks seemed to offer. Judd<sup>7</sup> has reported a number of such cases without jaundice and suggests that obstruction was present, but did not last long enough to produce jaundice. He thinks twelve hours of obstruction are necessary in order that jaundice may appear. Both of my cases have continued to have their attacks after a short remission.

In the earlier part of this paper, the writer has expressed a preference for cholecystectomy in cholecystitis and stone. It has been mentioned, however, that no one should attempt operation without a willingness to do a cholecystostomy or a partial resection in the presence of insuperable difficulties. The number of cases where a cholecystectomy would seem too difficult will depend on nothing more than the operator's own experience. The least experienced should be satisfied with a cholecystostomy even though a second operation must be expected. There is, however, one very great objection to cholecystectomy and that is the danger of damage to the hepatic or common ducts. In conversation with operators who have not had personal experience with injury, all seem to assume that the damage results from traction on the cystic duct, thus angulating the hepatic and common with the

resulting ligation or excision at the point of union of the three ducts. In the cases of which the writer has a more or less intimate personal knowledge from operation, autopsy or accurate description (probably ten cases, all told), the evidence is all against this form of production. This brings us to a discussion of the two methods of performing a cholecystectomy. Nearly all recent discussions mention favorably the operation beginning at the cystic duct and working outward. Some have been so insistent as to make it appear that this is the only proper way to remove the gall-bladder. One no doubt should be familiar with the two technics—that from without and that from within. And one will see cases in which each has considerable advantages. My own feeling is very strong that the removal beginning at the fundus is the easier, safer method in the great majority of cases. The removal from within outward seems to me a rather spectacular method of operation for an easy case. In the cases, however, where infection, gangrene and impacted stone in the ampulla or cystic duct make the recognition of anatomical structures difficult, it seems to me after an experience of between four and five hundred gall-bladder and duct cases, that the operation from the fundus has very considerable advantages and would seem very much less likely to result in injury to the hepatic ducts. In an easy case, I decided to remove the gall-bladder from within, grasped the ampulla with forceps to make traction and put a clamp on the duct just beyond. For some reason, I reverted to the other method, leaving the clamp still across the duct. When the gall-bladder had been enucleated, to my surprise I found the clamp straight across the common duct. The cystic duct had made a sharp turn backward and the ampulla was in contact with the common duct. This is the nearest I have come to dividing the common duct. I have seen a surgeon of experience damage the hepatic duct in a very easy case. Erdmann<sup>8</sup> reports such an accident in an easy case and thinks it was due to the spiral relation of the cystic to the common duct. In my own cases—three in number—and several cases seen with Doctors Douglas and Downes at St. Luke's Hospital, the evidence has all been that the duct originally injured was the hepatic. I made a very successful reconstruction in a case where the biliary sinus ran down to the portal fissure thence into the liver. It seemed as though the division of the hepatic ducts, had been flush with the under surface of the liver and that the stump had retracted inward. The injury, I learned, had occurred in the course of the removal of a gall-bladder without stones in a female of twenty-two years. In two cases seen at autopsy, after draining of the distended hepatic duct, it was apparent that the injury was at the portal fissure. In none of these cases has there been reason to think that the operator knew that he had damaged the duct at the conclusion of his operation. If one takes the trouble to locate the hepatic duct after enucleating an adherent gall-bladder, he will be surprised to find how near the hepatic duct is to the bed of the gall-bladder. Let us assume, then, that the cystic artery is cut and bleeding and that instead of controlling bleeding by pressure then accurately clamping the bleeding point, that a clamp is applied across the mass

of tissue containing the vessel. Then the clamp will include the cystic artery and the hepatic duct, after which a mass ligature will control the bleeding. But in the next few days, jaundice will appear, to be relieved later by a flow of bile when the pedicle sloughs.

The immediate mortality in cases of this sort may be high. We shall not know how high, for they will not be reported. The cases are seen when demanding secondary operation, either for fistula or jaundice. In the three cases in which I have operated, one died in fourteen days following a drainage as the result of hemorrhage only temporarily controlled by transfusions. In a second, a reconstruction of the duct resulted in permanent cure in a patient whose bile had drained externally for a year. The third patient was operated on three times by another surgeon and three times by me and is now, after six years, in fairly good health interrupted by an occasional attack of cholangitis.

It seems curious that a patient can remain in good health for long periods of time draining all bile externally. The loss of bile salts renders the bile in these cases, according to common report, very low in bile salt content. Physiologically, we are told that bile salts aid in keeping the cholesterol and pigment in solution, yet the cases with prolonged external drainage do not, on that account, seem to form stones.

Leahy<sup>9</sup> has recorded a case of his own and one of Dr. Hugh Williams in which a gall-bladder sinus has been employed in the making of an internal fistula. As a last resort one might attempt such a procedure but, remembering that the common duct which, after division, finally closes off with a resulting jaundice, one would doubt the permanency of any fistula which did not become epithelialized. I was expecting in one case to use a sinus in the formation of an internal fistula, but finally followed the sinus down and identified the cystic duct which had a slight mesentery, inserted a tube in it and then made an anastomosis with the duodenum. The result has been satisfactory for more than a year. This case has made me more than ever satisfied with the removal of the gall-bladder without removing the cystic duct. I have twice seen the cystic duct dilated after cholecystectomy. In one case it caused symptoms and required removal. Erdmann<sup>8</sup> has published a valuable paper describing a method he has employed in eight cases of injury to the bile ducts. It is an hepatico-duodenostomy with the tube retained in place long enough for the tract to become epithelialized.

## SUMMARY

1. A right rectus incision answers except in very unusual cases.
2. Cholecystectomy is rapidly replacing cholecystostomy.
3. The protection of the deeper ducts is facilitated by enucleation from fundus to duct.
4. With the spread of cholecystectomy, we shall hear of more injuries to the hepatic and common ducts.

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5. It is neither necessary nor advisable to postpone operation in acute, simple gall-bladder cases.

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## CANCER OF RECTUM AND RECTO-SIGMOID\*

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CANCER of the rectum composes about 80 per cent. of intestinal cancers, according to Gant, Ball and Halstead. Next to cancer of the stomach it is the most frequently encountered cancer of the gastro-intestinal tract. Of 561 cases of cancer of the gastro-intestinal tract reported by Mayo (1908-1909) 387 were of the stomach, sixty-nine were of the large intestines, three of the small intestines and ninety-two were rectal. Lynch, quoting the Vital Statistics of the Registration Area of the United States, says that cancer of the rectum has increased 100 per cent. in the past fifteen years.

As with cancer occurring in other parts of the body, it is most common after middle life. Fifty years was the average age of the one hundred cases comprising this report, the youngest being twenty-two years and the oldest seventy years of age. While carcinoma of the rectum in childhood is rare, it is by no means unknown. Twelve cases of carcinoma of the rectum and sigmoid were observed by Henning in one million living children under fifteen years of age; six of them between five and ten years and six of them between ten and fifteen years. Von Bergman states that it occurs in children under ten years of age and thinks it may be due to the frequency of adenoid growth of childhood. In 5279 cases of carcinoma of the rectum and sigmoid Weinlechner found eighteen in children up to fourteen years of age. Phifer in a careful search of the literature, found forty-nine cases of cancer of the rectum or sigmoid in children or adolescents under twenty years of age. He states, "What strikes one in reading the histories of these cases is the rapidity of the evolution of the cancer. From the time that the first symptoms were clearly evident until death, seven to eight months, rarely more time elapsed. The affection in the young is, therefore, almost fulminating."

Carcinoma of the rectum is a slow growing tumor with late extension into the neighboring peri-rectal tissues, the retro-rectal lymph-nodes and adjoining viscera. Hausmann, of Vienna, found in 112 intestinal tumors that came to autopsy that fifty-five had not extended beyond the intestinal wall, and Jones' and McKittrick's pathologist reported 68 per cent. of the cases operated by them showed no involvement of the peri-rectal tissues or lymph-glands. If these statements are true, 50 per cent. of the patients surviving the operation should be cured over a span of years beyond the three- or five-year period. Unfortunately, the most extensive operations done by the most experienced and ablest operators are productive of no such glowing results. Mayo reports 28.3 per cent. as living five or more years after operation. Jones and McKittrick, who prefer an extensive abdomino-perineal operation in one-stage, their last twenty-four operations without a death, report

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11.3 per cent. living five years or more. A thorough understanding of the lymphatic drainage of the rectum is essential in the choice of operation. Miles' description of the lymphatic spread is most comprehensive and instructive. He describes three zones of extension. First: downward, into the perineal body, into the ischio-rectal fat, and into the external sphincter. Second: laterally, into the levators, the recto-rectal lymph-nodes, the lymph-glands in relation to the branches of the internal, iliac vessels, the prostate, the base of the bladder, the posterior vaginal wall, and the broad ligaments. Third: upward extension, into the floor of the peritoneum, the pelvic meso-colon, and the glands at the bifurcation of the common iliac artery on the left side. The choice of operation is not difficult to decide if we accept Miles' statement, and I believe we have to, for he has arrived at his deduction in a most logical and painstaking way, after having observed the lymphatic extensions in a large series of recurrent carcinomas of the rectum.

The abdomino-perineal operation, with a careful exploration of the abdomen for metastases, I believe, is unquestionably the operation of choice in those cases in which the magnitude of the operation does not jeopardize too greatly the patient's life. Whether this operation be done in one or two stages is a matter of choice or judgment of the operator. There are strong advocates of both the one- and the two-stage operation. The one-stage perineal operation seems to me to have a field of real usefulness in those patients afflicted with obesity and in those with marked debility, since this operation is accompanied by less shock and infection of the peritoneal cavity is less apt to follow.

There were fifty-six males and forty-four females in our group, upon forty-five of whom a radical operation was done. A palliative operation, usually a colostomy, was done upon thirty-seven patients which were considered inoperable, either before or at the time of operation, the colostomy having been done for the relief of obstruction or to prolong life. By side-tracking the intestinal contents, the tumor is retarded in its growth and considerable comfort and prolongation of life is to be had. Four of the colostomies done for inoperable growths were benefited to the extent of relief of obstructive symptoms and prolongation of life, two living two years, and two living three years. Eighteen left the hospital without operation, for various reasons: inoperability, refusal of operation, and so forth.

Of the forty-five radical operations performed, seventeen lived more than one year, sixteen died within three months, either at the hospital or at home, twelve we were unable to trace, patients having died or having changed their addresses, as is frequent in large cosmopolitan cities where the people are constantly changing their abode. These, however, we include among the dead, leaving seventeen that lived one year and over. One of the deaths should be considered accidental rather than operative, the patient having made a most happy recovery after operation for a small moveable recto-sigmoid growth, which was removed by mobilizing the lower sigmoid and upper rectum, then telescoping the growth into the lower rectum through the external sphincter.

the growth being amputated a few days later and the gut sutured at this point. Two months later a stricture at the line of suture had formed, dilatation of this resulted in peritonitis and death.

In our group of seventeen cases that lived over one year, eight were one-stage perineal or sacro-perineal excisions. There were four in which the two-stage abdomino-perineal operation was done, and three in which one-stage abdomino-perineal operation was done.

Two very small growths discovered through the sigmoidoscope, 18 cm. from the anus, could be mobilized to the extent that a Mikulicz operation could be done. In one of these the growth could not be delivered out of the incision onto the abdominal wall. After suturing the limbs of the gut together the anterior parietal peritoneum was turned backward and sutured to the lower portion of the intestinal loop, thus excluding the peritoneal cavity, making this portion of the gut, including the tumor, extra-peritoneal. The abdominal wound with the rectus muscle was kept open around the gut with gauze packing. Six days later the growth was amputated and the clamp introduced to cut through the spur. A point of interest in this procedure is that the colostomy closed spontaneously, requiring no third-stage closure as is usual in the Mikulicz operation. Of the above cases eight are living and well five years after operation: four, three and a half years; one, two and a half years; and one, one year. The remainder of the group lived from two to six years, average three years and four months of life.

Metastasis occurred in about 70 per cent. of the cases operated upon: Retroperitoneal glands, 26 times. Peri-rectal tissues, 15. Metastasis outside of bowel, 9. Liver, 12. Bladder, 7. Uterus and vagina, 2. Pulmonary, once.

The average duration of symptoms was approximately eight months. Pain, constipation and bleeding from the rectum were the three symptoms most frequently complained of; added to these was the so-called diarrhoea, in reality a bloody mucus discharge causing a frequent desire to evacuate the rectum. Loss of weight and strength, a feeling of weight in the rectum, vomiting, digestive disturbances, and tape or ribbon-like defecations, with a feeling of not having evacuated the rectum and a desire to return to toilet, were not infrequently mentioned amongst the other symptoms. The diagnosis should not be difficult since these growths of the rectum and the recto-sigmoid are all within easy reach of the examining finger, or can be seen through the sigmoidoscope. I believe every case that suggests an intestinal lesion should be carefully sigmoidoscoped. Eight of our cases had been recently operated upon for hemorrhoids, the real lesion existing at the time was undiscovered from failure to make a careful examination. I further believe that a section should be removed for microscopical examination, and I do not think that the danger incurred in so doing is comparable to the danger of so grave an operation as the radical operation for carcinoma of the rectum. The failure to remove a specimen for examination in two cases during the

## CANCER OF RECTUM AND RECTO-SIGMOID

past few years at the Roosevelt Hospital resulted in the removal of two rectums that were reported by the pathologist to be non-malignant.

The operative treatment we have mentioned. No effort is here made to discuss the technic of the operative procedures as time and space will not permit. It was the fondest hope of the profession that radium might be used with the brilliant result in carcinoma of the rectum as in carcinoma of the cervix, but unfortunately we have been doomed to disappointment. I have had no personal experience with radium in carcinoma of the rectum. Coffey mentioning eight cases so treated says that the suffering is unspeakable and the results disappointing and states, "I shall not use radium in carcinoma of the rectum again, except for some very extraordinary reason."

I wish to extend my sincere thanks to Doctors Dowd, Peck and Hotchkiss for permitting me to include their cases in this report.

## A CONTRIBUTION TO THE STUDY OF THROMBO-ANGIITIS OBLITERANS

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THROMBO-ANGIITIS OBLITERANS is a disease which has been generally believed, in America, to be racially confined almost exclusively to Jews from Russia and Poland. The pathology of the condition was first accurately described, and it was first recognized as a clinical entity by Buerger in 1908.<sup>2</sup> Since that time he and others have contributed, from an extensive experience with the disease, additional information regarding its clinical aspects, its pathology and its treatment. From these reports we have a fairly clear conception of the means of diagnosis and of the clinical course of the disease.

Without attempting to review these in detail, but rather to call to the reader's attention the outstanding features of the disease, it may be stated that thrombo-angiitis obliterans is a chronic disease of the blood-vessels resulting in thrombosis and gangrene. It usually occurs in relatively young male adults. One or more of the extremities may be involved. Its early symptoms are usually pain and coldness of the extremities with a gradual discoloration of the toes or the distal part of the foot. In the course of weeks or months or years certain areas slowly become frankly gangrenous. As the gangrene develops there is increasing pain which is constant and severe—becoming more and more unbearable and finally keeping the patient awake at night, driving him to take opiates or to come to the surgeons for relief by amputation. The gangrene is usually of the dry type, but secondary infection may develop in the tissues above the gangrene. These tissues are usually purplish in color when the foot is dependent, but take on a death-like pallor when the foot is raised. On lowering the foot again the color very slowly returns. No pulsation of the blood-vessels can be felt for a considerable distance above the gangrene, and usually the vessels themselves are not palpable. It must be differentiated from certain other conditions giving rise to gangrene. (a) Frostbite usually gives a history of exposure followed rapidly by gangrene. It is frequent in children and in women. As a rule it is not very painful. The neighboring vessels are normal. (b) Arteriosclerosis generally occurs in older persons. The vessels can be felt as "pipe stems." It is usually not very painful. (c) Diabetic gangrene is of the arteriosclerotic type. Sugar is present in the urine and abnormally high in the blood. (d) Raynaud's disease occurs more often in women than in men and generally in those of a neurotic temperament. It manifests itself in transient periods of discoloration and coldness of the extremities and only rarely results in gangrene. It is usually symmetrical. The pulses are not obliterated.

## THROMBO-ANGIITIS OBLITERANS

Although the pathology has been carefully described in its various phases, the pathogenesis is not sufficiently understood to reveal either the actual or the predisposing causes. The bacteriological findings of Rabinowitz<sup>6</sup> are most interesting, but will have to be extended and confirmed by others before the bacillus which he describes can be definitely accepted as the causative organism. The bacteriological field of research in this disease is promising, for there is much pathological evidence that the primary inflammation of the vessels is similar to inflammatory processes known to be caused by bacteria. Some predisposing cause must eventually explain the predominance of its occurrence in males, either by some inherent differences in the sexes or some striking differences in habit or occupation. With regard to the treatment of the disease the medical profession appears to be quite unsettled, although certain individuals ardently advocate this or that method. The natural remissions of the disease often give false impressions of the efficacy of one or another form of treatment.

Our purpose in adding to the literature on the subject is to present certain observations on twenty-five cases of the disease seen in China, thus definitely establishing the fact, previously reported in certain oriental journals, that it is relatively common among the yellow race; to report the results of certain clinical and laboratory studies made on these cases which appear to us to be worth recording in the general literature; to offer certain conclusions to which we have been forced by the poor results of our treatment in some cases and finally to outline briefly the only female case in our series because of the rarity of such an occurrence.

In 1917, Whyte<sup>7</sup> reported a number of clinical observations of this disease in Swatow, China, and later<sup>8</sup> made a rough survey of its occurrence in other parts of China by means of a questionnaire which he sent to outlying medical missionaries. He found that it had been observed clinically in almost all of the provinces of China. Pathological confirmation was lacking in most cases, but the differentiation from other forms of gangrene being considered by him to be relatively easy, he felt justified in stating that it occurred widely throughout China. We have confirmed his findings by a similar survey. Fifty-one out of one hundred and nineteen medical men all over China who returned the questionnaire, recognized the disease in their clinics. From a number of places we have received photomicrographs of stained sections and

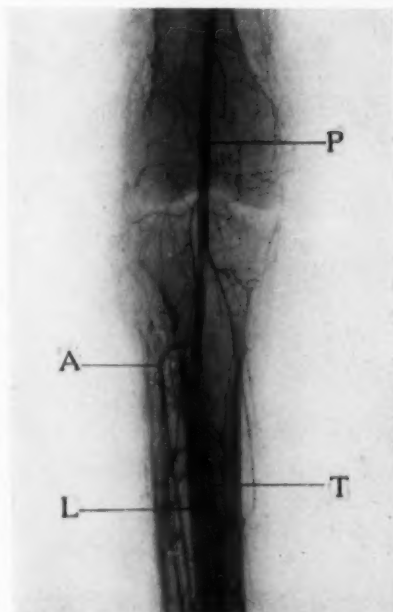


FIG. 1.—Normal leg with arteries injected with barium suspension. Popliteal P, anterior tibial A, posterior tibial T, peroneal L. The barium injections in these specimens were made by Dr. Paul H. Stevenson, of the department of anatomy.



pathological material which establish the diagnosis beyond question. It apparently occurs in all parts of China and is fairly evenly distributed throughout a wide range of climatic conditions and among people differing widely in their habits of living and eating.

Our series of twenty-five cases represents almost one per cent. of the surgical in-patients for the last three years. In every instance microscopic examination has been made of the diseased tissue. The cases have shown almost every feature of the process which Buerger has described, from the earliest evidences of inflammation to the densest obliteration of both veins and arteries, the canalization of these vessels and the secondary involvement of the new blood channels. We have included in this series one case which came to us occurring in a Polish Jew because it illustrates so well the recurrent migrating phlebitis which, as Buerger<sup>3</sup> has pointed out, may be an early manifestation of the disease.

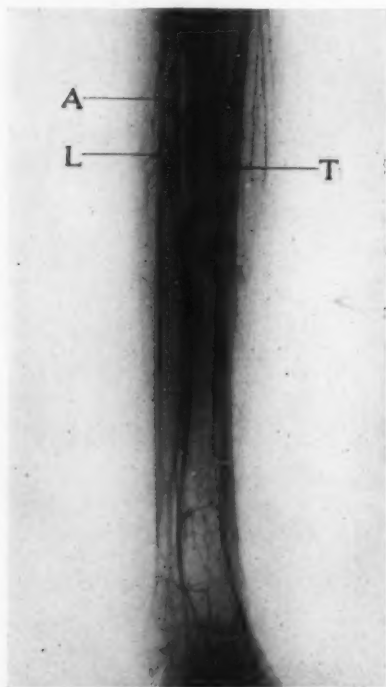


FIG. 2.—Normal leg with arteries injected with barium suspension. Anterior tibial A, posterior tibial T, peroneal, L.

*Clinical.*—Our cases presented no striking features, in the clinical aspects of the disease, differing from most of the descriptions given in the literature. However, certain points seem worthy of mention. In our series there were twenty-four males and one female. The age incidence ranged between twenty-four and sixty, with almost one-half in the fourth decade of life. When questioned concerning their occupation, it was found that almost all of them were of the laboring class. Careful questioning brought out the fact that only sixty per cent. of the cases used

tobacco. A history of previous diseases is unreliable in Chinese patients, names not being generally known and symptoms quickly forgotten, but malaria was definitely noted in eleven cases and typhus in two. A positive Wassermann was found in only two of the cases. This corresponds fairly closely to the percentage of positive reports obtained in the routine examination of all surgical cases admitted to the hospital.

On admission the patients complained chiefly of pain and the self-evident gangrene. The dull red color of the tissues above the area of gangrene, frequently accompanied by oedema of the tissues, was often difficult to differentiate from the appearance of cellulitis. In almost every instance there was some secondary infection with pyogenic organisms and this had to be taken into account when the method of treatment was decided upon. Evidence of infection was seen in the majority of the cases. On admission

three-quarters of the cases had some fever. Three of them showed a temperature of 39° C. or over. These three developed an infection in the operative wound and one of them died with a general sepsis.

Blood-pressure in general was not high. In no case was the pressure greater than 140 mm. of mercury in the arm or 180 mm. in the leg. An examination of the various systems for foci of infection was generally negative. Pyorrhœa alveolaris was common but, as it is present in about seventy per cent. of all adult Chinese, it is probably without special significance in this disease. Three out of twelve in which careful eye examinations were made, showed some disease of the retinal vessels. The others were normal.

Meyer's theory<sup>5</sup> with regard to a disturbance of carbohydrate metabolism was not borne out by our determinations of blood sugar. The fasting blood of twenty of our cases was tested. Fifteen cases were within normal limits. The other five were slightly increased. Eight of the cases were tested again one hour after the ingestion of 100 grams of glucose. Six of these were normal and the other two returned to normal in another hour. The urine was never positive for glucose.

Blood cultures were not done in enough of the cases to make our report of much value. It should be recorded, however, that with the Rabinowitz technic,<sup>6</sup> four negative cultures were obtained. Cultures of the tissues in the neighborhood of the involved vessels gave a variety of organisms. Staphylococci were frequently found and also a number of different gram-negative bacilli were found. This phase of the problem requires further investigation.

*Pathological.*—The extent of the gangrenous process, in the cases of our series, is shown in Table I. So far as the material has permitted, we have made an examination of the blood-vessels, nerves and lymphatics at several different levels. Our findings seem to argue against the general impression that the process is an ascending one, for we have frequently found the vessels occluded above and perfectly free below or occluded above and below and free in the middle. The involvement may be described as patchy. These points are more clearly brought out by Tables II, III, and IV. This irregular involvement suggests that the lesion does not spread from a single focus,

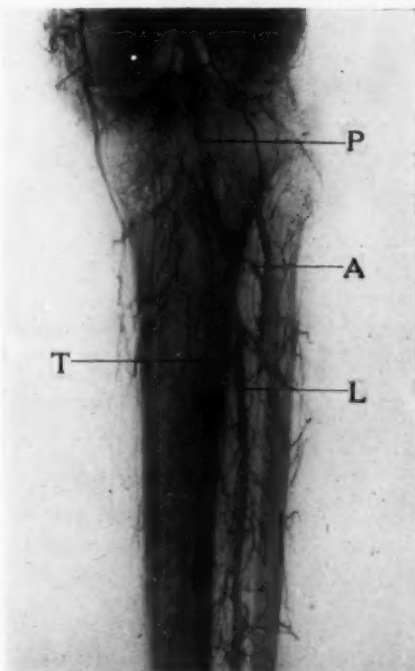


FIG. 3.—Case 6750. Showing the patchy irregularities along the popliteal P and anterior A and posterior T, tibial arteries, and the large and numerous collateral vessels. The peroneal artery L is well preserved and larger than normal.

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either upward or downward, but rather that it begins in several places at once. This in turn suggests a blood-borne infection. It is particularly worthy of note that so many of the cases showed a recent or active process in one or

TABLE I.  
*Showing the Extent of the Lesion when the Patients were  
Admitted to the Hospital.*

Gangrene of toes only .....	8*
Gangrene of toes and dorsum of foot .....	5
Gangrene of distal half of foot .....	4
Gangrene of whole foot and part of leg .....	3
Gangrene of toes and ulcer of heel .....	3
Gangrene of finger and toes .....	1
Gangrene of finger, toes and dorsum of foot .....	1
No gangrene (migrating phlebitis) .....	1

\* This includes a patient with both feet gangrenous. Counted as 2.

more of the vessels. It is possible that in some at least, the acute process may be due to the secondary infection and yet in others giant cells point to an active process of the specific disease thrombo-angiitis obliterans.

TABLE II.  
*Showing the Nature of the Process in each Vessel Examined in 22 Cases  
Receiving Radical Treatment.*

Name of vessel		No. of cases examined	Thrombosis present	Old	Recent	Combined
Femoral	Artery	1	1	1	0	0
	Vein	1	0	0	0	0
Popliteal	Artery	11	10	5	2	3
	Vein	11	0	0	0	0
Posterior tibial	Artery	21	18	14	3	1
	Vein	21	7	3	3	1
Anterior tibial	Artery	21	14	13	0	1
	Vein	21	5	2	3	0
Peroneal	Artery	17	2	2	0	0
	Vein	17	1	1	0	0
Dorsalis pedis	Artery	21	12	10	0	2
	Vein	21	4	3	1	0
Digital	Artery	5	5	5	0	0
	Vein	5	0	0	0	0
Nerve	Artery	21	10	7	2	1
	Vein	21	0	0	0	0
Superficial vein .....		5	4	3	0	1

The patchy involvement of the vessels is perhaps more clearly demonstrated by X-ray pictures of injected vessels. These also show the development of collateral circulation. It would be most helpful in deciding the level

# THROMBO-ANGIITIS OBLITERANS

for amputation if this could be done in the living patient. The results that Brooks<sup>1</sup> has already obtained with intra-arterial injections of sodium iodide, suggest that some such method may eventually be practical but at present there is no way to demonstrate clearly the extent of the collateral circulation. Brooks' method does not show very many of the smaller branches. A comparison of Figs. 1 and 2 which show a normal leg injected with a thick suspension of barium, with Figs. 3, 4 and 5, which show the legs from two of our cases injected in the same manner, will bring out the following points. (a) The normal arrangement of the blood-vessels is absent in the diseased

TABLE III.

*Showing the Nature of the Process in all of the Cases of the Series.*

Old process only.....	11
Recent process only*.....	3
Old and recent in same vessels.....	7
Arteries only involved.....	12
Both arteries and veins involved.....	10
Veins only involved*.....	2
Veins involved, arteries not examined†.....	2

\* Two of these were in the same patient. Case No. 3766.

† One of these had a simple toe amputation. The other was the case of migrating thrombophlebitis.

legs. (b) The main trunks show patchy defects of the vessel walls. (c) In some places there is a complete obliteration with filling below by means of anastomotic branches. (d) The collateral vessels are abundant and large. (e) Even the smaller vessels show defects and in many places obliteration. Figs. 6 and 7 show the injected feet in two of our cases. Here it is seen that the gangrenous areas are entirely without blood supply. Fig. 6 shows the tissue around the gangrenous area richly supplied with collateral circulation while Fig. 7 shows the number of patent vessels very gradually diminishing.

TABLE IV.

*Showing the Irregularity of Vessel Involvement in 21\* of the Cases Receiving Radical Treatment.*

Upper thrombosed, lower thrombosed.....	Arteries 13	Veins 0
Upper thrombosed, lower patent.....	Arteries 5	Veins 7
Upper patent, lower thrombosed†.....	Arteries 1	Veins 3
Upper patent, lower patent.....	Arteries 2	Veins 11

\* The other case receiving radical treatment was gangrenous almost to the knee and the vessels were examined only at one level.

† The low figures here suggest that it is not an ascending process in most cases.

These findings correspond in the first case to a sharply defined line of demarcation on the gross specimen. In the other there was no line of demarcation.

Characteristic microscopic findings are illustrated in Figs. 8 to 17. From our microscopic study, we feel confident that the initial process of this disease is inflammatory. It may be either mild or severe. In or about many of the vessels which show no actual thrombosis, foci of wandering cells, usually of the mononuclear type, are found. In the most acute stages there is evidence of a very strong polymorphonuclear chemotaxis and in many vessels containing fresh thrombi, polymorphonuclear leucocytes are found clinging

TABLE V.  
*Giving a General Summary of the Cases of Our Series.*

Hospital number	Sex	Age	Occupation	Tobacco used	Extremities affected				Wassermann	Pulsation of vessels			Operation amputation	Wound healing	Result on discharge.
					R. U.	L. U.	R. L.	L. L.		Pop.	Post. tib.	Dors. ped.			
1.	M.	33	Soldier	Not given	0	0	+	0	0	0	0	0	Thigh	Primary	Improved.
2.	F.	48	Housewife	0	0	0	+	0	0	+	0	0	Leg	Secondary	Improved.
3.	M.	31	Farmer	0	0	0	+	0	0	+	0	0	Leg	Secondary	Unimproved.
4.	M.	38	None given	0	0	0	0	+	0	0	0	0	Thigh	Secondary	Unimproved.
5.	M.	46	None given	0	0	0	+	0	0	+	0	0	Leg	Secondary	Improved.
6.	M.	27	None given	0	0	0	+	0	0	+	0	0	Leg	Primary	Improved.
7.	M.	30	Soldier	+	0	+	+	0	0	+	0	0	Leg and finger	Secondary	Improved.
8.	M.	37	Peddler	+	+	0	+	+	0	+	0	0	Leg	Secondary	Died.
9.	M.	36	Beggar	+	0	0	+	+	+	+	+	≠	Both legs	L. secondary R. primary	Improved.
10.	M.	34	Farmer	0	0	0	0	+	0	0	0	0	Thigh	Primary	Improved.
11.	M.	42	Laborer	+	0	0	0	+	+	≠	0	0	Leg	Primary	Improved.
12.	M.	41	Farmer	+	0	+	+	+	0	0	0	0	Thigh	Primary	Improved.
13.	M.	39	Laborer	+	0	0	+	+	0	≠	0	0	Leg	Primary	Improved.
14.	M.	24	Farmer	0	0	0	+	0	0	0	0	0	Thigh	Primary	Improved.
15.	M.	35	Laborer	+	0	0	0	+	0	+	≠	0	Toe (conserv.)	Secondary	Improved.
16.	M.	49	Pol. Jew Merchant	+	0	0	0	0	0	≠	≠	0	Phlebotomy	Primary	Unimproved.
17.	M.	39	Farmer	+	0	0	+	+	0	0	0	0	Thigh	Primary	Improved.
18.	M.	35	Miner	0	+	+	+	+	0	0	0	0	Finger	Primary	Unimproved.
19.	M.	41	Farmer	+	0	0	+	+	0	0	0	0	Thigh	Secondary	Improved.
20.	M.	46	Farmer	+	0	0	0	+	0	0	0	0	Thigh	Left open	Died.
21.	M.	25	Farmer	0	0	0	0	+	0	0	0	0	Thigh	Secondary	Improved.
22.	M.	60	Teacher	+	+	+	+	+	0	0	0	0	Toe	Secondary	Unimproved.
23.	M.	42	Pawnbroker	+	0	0	+	+	0	0	0	0	Thigh	Primary	Improved.
24.	M.	42	Farmer	0	0	0	0	+	0	0	0	0	Thigh	Secondary	Improved.
25.	M.	49	Farmer	+	0	0	+	+	0	≠	0	0	Leg	Secondary	Unimproved.

\* Left leg amputated 10 years ago.

† Refused treatment for leg.

‡ Refused amputation of leg.



to or invading the walls of the vessels. The case of migrating phlebitis in this series had all of the cardinal signs of an acute inflammation in his saphenous vein. This had been a recurrent process for six years. There was no gangrene present, but his extremities were cold; he complained of the symptom of angina cruris, his popliteal pulses were barely palpable, and the dorsalis pedis arteries could not be felt on either side. A section of the inflamed vein showed an old occluding thrombus with a purulent focus in the centre of the thrombus and several giant cells. (See Fig. 14.) The tissues and smaller vessels in the neighborhood contained large numbers of polymorphonuclear leucocytes.

Usually the thrombi completely occlude the vessels and gradually become organized by the ingrowth of fibroblasts and blood-vessels from the vessel walls, and although the new-formed connective-tissue contracts as it becomes older, new vessels of considerable size form channels within the thrombus. These new vessels frequently develop thick muscle walls and elastic lamellae. Injections with barium show that they carry blood and may play an important part in the later circulation to the regions once supplied by the normal vessel. They may, in turn, be involved in a recurrence of the disease. The vessels are not always completely occluded by the thrombus. Certain of them may show mural thrombi. In some cases this may represent the extension of a thrombus, which at another level completely fills the vessel, but we believe that mural thrombi may result from a relatively mild inflammation of the vessel wall or of the intima.

The process in certain of the main arteries of the big nerves is most interesting. In almost one-half of our cases there has been a complete occlusion of these nutrient vessels while a few have shown mural thrombi. The process is well illustrated in Figs. 15, 16 and 17. An attempt to correlate this finding with the history of severe pain, such as to keep the patient awake at night, revealed the fact that that symptom was present in every case of nerve vessel occlusion. On the other hand, the symptom was sometimes present when we were unable to find the occlusion. A number of examinations were made for the purpose of trying to demonstrate nerve degeneration in these cases, but we found no absence of axis cylinders and no destruction of the myelin sheaths. This is interesting in view of the delicacy of nervous

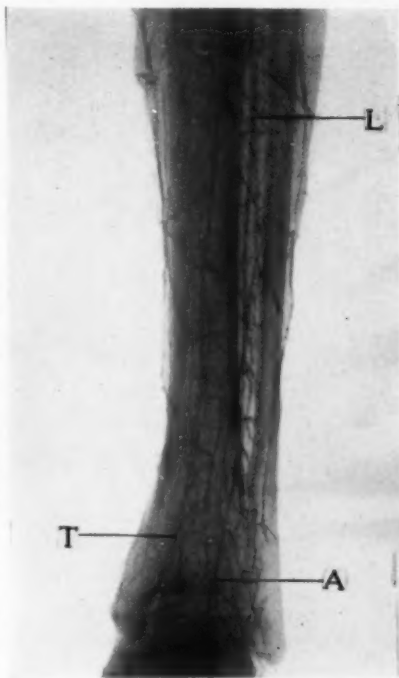


FIG. 4.—Case 6750. Showing the extensive collateral circulation and the very small lumina of the anterior A and posterior T tibial vessels. The peroneal artery L is well preserved.

tissue in the cord and the rapidity with which a cutting off of the blood supply will cause a degeneration of the central nervous tissue. However, it is well known that paralysis and anæsthesia seldom occur in these cases. Whether or not the characteristically excruciating and persistent pain present in this form of gangrene and absent in most of the other forms, is due to the thrombosis of these nutrient nerves, it is impossible to say definitely, but it is suggestive. Buerger<sup>2</sup> more particularly calls attention to the general fibrosis around the whole vessel-nerve cord, as the possible explanation of the pain symptom.

An interesting condition not always recorded in descriptions of this disease is chronic ulcer of the heel. This was present in conjunction with gangrenous toes in three of our cases. All of these showed typical old thrombotic processes in the popliteal artery.

Forty per cent. of our cases at various times had more than one extremity involved in a gangrenous process. Ten per cent. had had previous operations on other members, while almost thirty per cent. gave evidence of spontaneous healing of at least one focus. These facts obviously give us a suggestion as to the most reasonable form of treatment. Spontaneous healing must presuppose that the disease

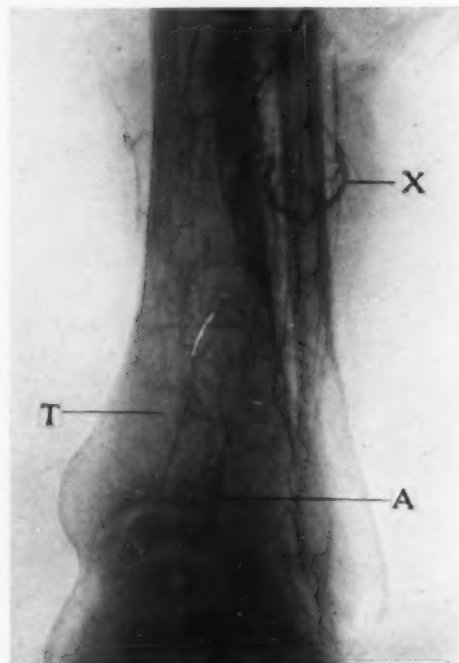


FIG. 5.—Case 7680. Showing a very large collateral vessel X, a very irregular anterior tibial artery A, and an obliteration of the posterior tibial artery T.

has come to a standstill or at least has subsided and that sufficient blood supply has developed, by means of collaterals, to permit the living tissue to separate itself from the dead and to supply the neighboring tissue with enough nourishment to grow and to cover over the defect. When there is to be separation of the dead tissue there is almost always a fairly rapidly developing line of demarcation. This takes place most often when a single finger or toe is involved. When a large mass of tissue is gradually deprived of blood, gangrene develops so slowly that the part may be said to be in a state of necrobiosis. Then there is no sharp line of demarcation and separation will take place very, very slowly, if at all.

From our study we have come to this conception of the pathological process. First, there is an acute inflammation of the arteries or veins or of both together. This is not uniform, but patchy, and may be more acute in some places than others, which suggests that there may be differences in the

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local concentration of the irritating substance or differences in the local condition of the vessel walls. The inflammation is followed by a thrombosis which more or less completely occludes the vessels affected. The general blood supply of the part is cut down, but in certain places blood goes in a roundabout way and supplies the tissues wherever the paths are open. This supply may or may not be adequate. If it is not adequate, the normal collateral vessels enlarge until the tissues are getting enough blood, or until they cannot enlarge any further. If the circulation is sufficient, there may be no clinical evidence of disease. If the circulation is not adequate, gangrene will develop in that portion of tissue not getting enough blood to live. Then, if the disease process subsides or comes to a standstill, and if the collateral



FIG. 6.—Case 7360. Showing gangrene of the first and second toes with very good collateral circulation of the neighboring parts. The gross specimen showed a sharp line of demarcation.

circulation is sufficient or can be developed sufficiently to adequately supply the living tissue close to the margin of the gangrene, there will be a sharp line of demarcation and separation will take place more or less promptly.

If the disease continues instead of subsiding or coming to a standstill, a contest develops between two forces, blockage of vessels on the one hand, and collateral blood-vessel development on the other. There is a limit to the speed in which collateral circulation can develop. At the present time one can only guess what it is which limits the speed of the disease process, but the outcome is determined by the relative speed of these two processes. After an equilibrium has been established following the first attack, if a second attack comes on or a dormant process becomes active again, the contest is renewed, the margin of safety is narrower, the potential capacity of collateral development is less and gangrene is more likely to develop than during the first attack.

Amputation has seldom, if ever, been performed before gangrene has taken place, and therefore we cannot know just what happens in the course of the

disease. If, however, an extremity has been cut off, enough material is usually available to enable the pathologist to make a very certain diagnosis. If several portions of each vessel are removed, it is almost always possible to demonstrate several different stages of the process. Some arteries or veins will show fresh thrombi with evidence of acute inflammation in the walls of the vessels. Others will show an early organization of an occluding thrombus without canalization, but with foci of round cells or giant cells. Other vessels will be found to be completely obliterated by a thrombus which has become organized and canalized by vessels penetrating the walls or directly penetrating the clot from its ends. Still others will show a new inflammatory process superimposed upon an old thrombotic process. This is perhaps the



FIG. 7.—Case 6750. Showing an extensive gangrene of the foot except on the outer side. The transition from dead to well nourished tissue is not abrupt as in Fig. 6. The gross specimen showed a very wide zone of necrobiosis. The blood supply of the outer side of the foot is probably carried by the peroneal artery which was well preserved. (See Fig. 3.)

most characteristic feature of the disease. Calcium may be deposited in the walls in small amount, but it is not the usual finding, and it is never as extensive as in arteriosclerotic vessels. With the exception of two or three of our cases, enough material was available to make certain of our diagnosis on these criteria. In the others the appearance of the tissues removed, strongly favored the diagnosis of thrombo-angiitis and the clinical symptoms combined with the pathological findings to make it almost certain. However, there is some question of diagnosis in case No. 3766, where the arteries were free down to the area of gangrene and the veins showed fresh thromboses.

*Treatment.*—In the treatment of these cases we have been radical for the most part. When the patients have given consent for amputation and have been willing to accept our judgment as to the extent, our criterion in deciding the best level has been the absence or presence of the popliteal pulsation. In the former circumstance we have operated above the knee. In the latter,

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we have amputated through the upper or middle third of the leg. However, a review of the results of this radical treatment has made us feel less assurance in accepting this physical finding as the basis for determining the nature of the treatment. Whyte<sup>7</sup> quotes Parkes Weber in saying that "the more one sees of this class of case, the less one favors any drastic operative interference." Many other writers agree with him in this.

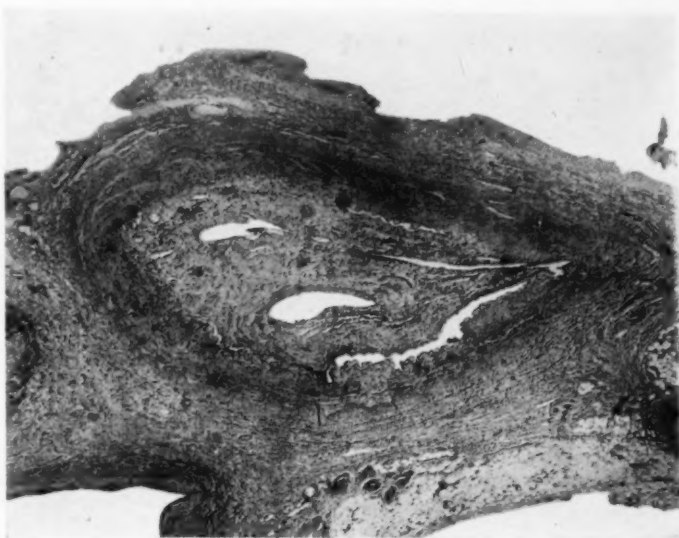


FIG. 8.—Case 6213. Femoral artery x15 showing an old obliteration with canalization.

Certain it is, that each case must be judged very carefully on its own merits and not be subjected to any hard and fast rule of treatment. A number of

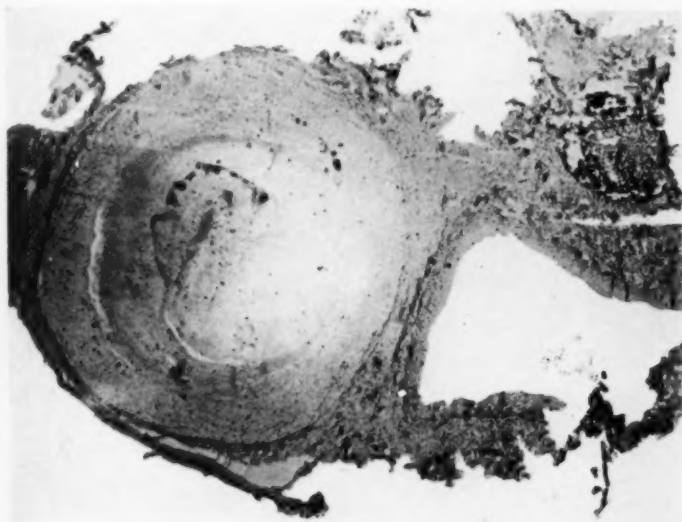


FIG. 9.—Case 565. Popliteal artery x10 showing a fresh thrombus in the artery and a focal deposit of lymphoid cells near the patent vein.

factors must be taken into consideration in deciding the form of treatment best suited to the particular case in hand. It must be constantly borne in mind that the disease is often spontaneously arrested and that the collateral circulation may develop an adequate blood supply.

There are probably very many mild cases which show no gangrene and rarely come under the observation of a surgeon. Our case of migrating phlebitis might be considered to be in this group. This is further illustrated by another case in



which gangrene had developed only two weeks before admission, but pathological examinations revealed an old process in the vessels. Another case complained of cold extremities for ten years, but had suffered with gangrene

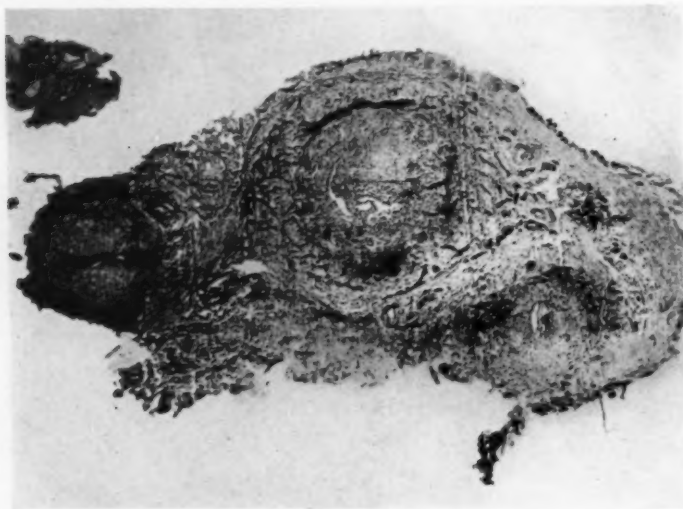


FIG. 10.—Case 2184. Anterior tibial vessels  $\times 21$ , showing an obliteration of the artery and the veins.

only eight months. In several of the cases a finger or toe had become gangrenous some years before, separation had taken place, the part had dropped off and the stump had healed with a relatively normal return of function. These facts suggest that, in a certain

number of cases, conservative treatment will give good results. It is obvious, however, that this group will only include those cases in which the collateral circulation has a reasonable chance of becoming adequate, that is, when the area involved is relatively small

and when there is evidence of a sharp line of demarcation between the living and the dead tissue. In these cases it seems reasonable to attempt to improve the circulation and to hasten the separation by whatever means can be safely applied. But if the



FIG. 11.—Case 859. In a female. Anterior tibial vessels  $\times 18$ , showing an obliteration of the artery and a thickening of the veins.

gangrenous area is large and there does not seem to be any natural effort to limit the process or to separate off the dead tissue, conservative treatment will not avail and the process will spread in spite of all that can be done.

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These cases demand radical amputation. In China, the element of time and the economic pressure on our patients have undoubtedly made us err on the side of radicalism in our treatment, and yet the results have not been highly successful. Of the twenty-two cases receiving radical amputation, eleven were amputated through the leg and eleven through the lower part of the thigh. Of the eleven leg cases, four healed by first intention and seven broke

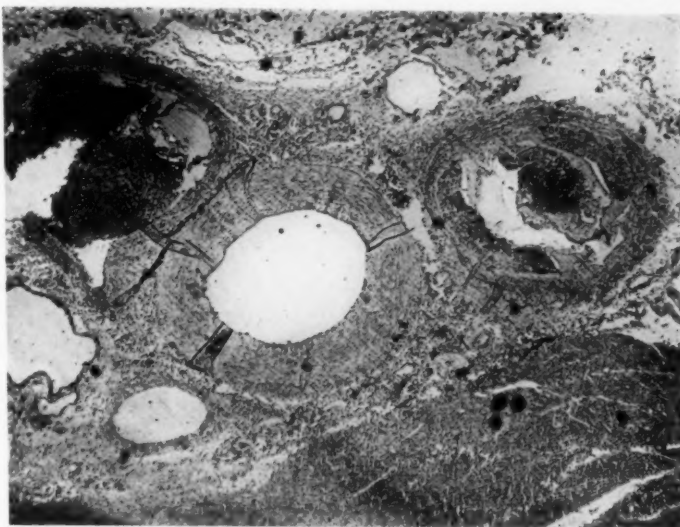


FIG. 12.—Case 3766. Posterior tibial vessels  $\times 18$ . The artery is free. Both veins show recent thrombi partially organized and infiltrated with many wandering cells. This patient had gangrene of the toes of both feet. No large arteries were found to be thrombosed. The diagnosis is not absolutely certain. The Wassermann reaction was positive.

down either with simple gangrene of the wound edges or with a frank infection of the wound. These latter cases took from one to four months

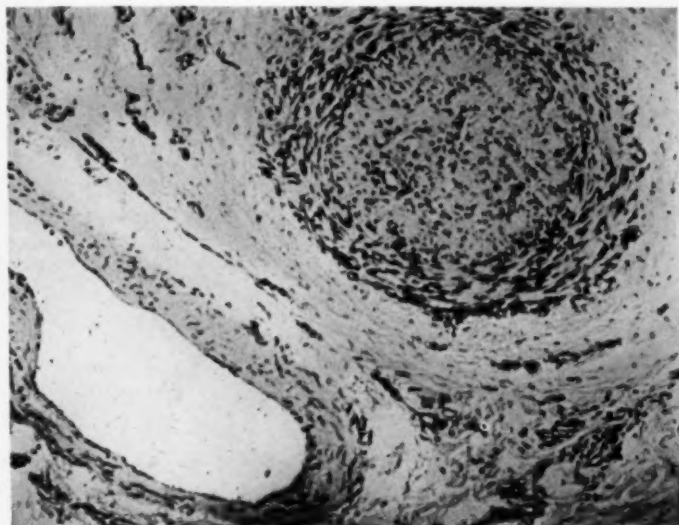


FIG. 13.—Case 6513. Digital branch to index finger  $\times 125$ , showing an obliterated artery and a free vein.

to heal. Of the eleven thigh cases, six healed per primam while five broke down. Thus with radical treatment, the immediate results as expressed in terms of wound healing was successful in less than half of the cases in which it was used. Of course it is not expected

that even when the wound heals primarily, the disease is in any sense cured, for it may return in the same or in a different member just as it may return

after a spontaneous amputation or after a conservative amputation. In a careful review of the failures in this series, we find that with possibly two

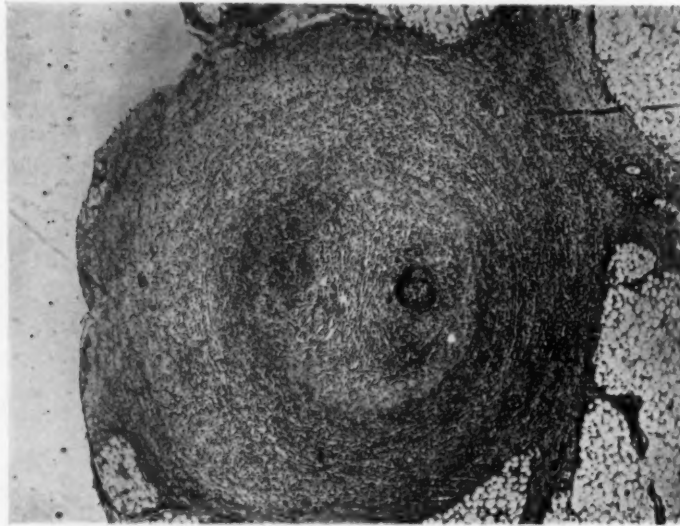


FIG. 14.—Case 6117. Migrating thrombophlebitis. Saphenous vein  $\times 16$ , showing an old canalized thrombus with a recent purulent focus and a number of giant cells.

exceptions they are cases which would have failed utterly with conservative treatment because there was no evidence of any effort at spontaneous separation or limitation of the gangrenous area. On the other hand, in reviewing the ten cases which healed, we find that all four of the leg cases

and one of the thigh cases might have been treated more conservatively with success.

By conservative treatment we mean conservative local amputation or débridement of the gangrenous area in those cases which of themselves give evidence of power to separate spontaneously and discharge the gangrenous tissue. In these cases also, other conservative forms of general treatment may be expected to be of some benefit. In the other

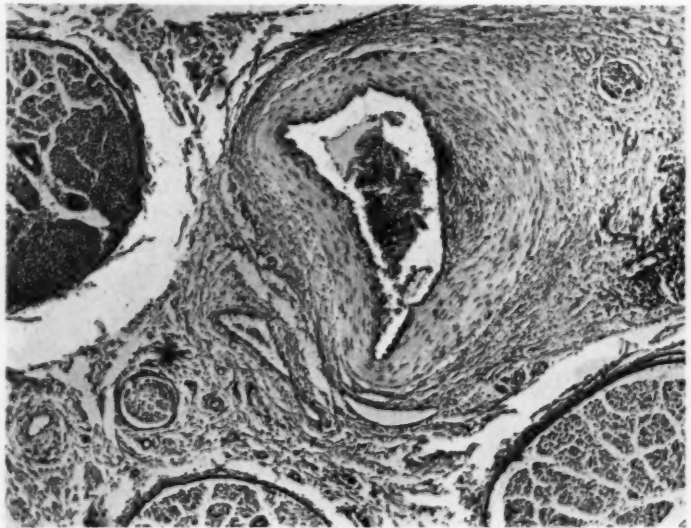


FIG. 15.—Case 5030. Nutrient artery of nerve  $\times 50$ , showing a mural thrombus and a focal deposit of lymphoid cells nearby.

cases these methods have been without avail in our hands at least. Ringer's solution given by duodenal tube in large quantities over a period of four

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months in one of our cases seemed to hold the condition almost stationary, but three months after discharge from the hospital the man returned and required a thigh amputation because of an extensive necrobiosis of the whole foot. In another case with duodenal flooding, the gangrenous process progressed steadily under treatment. In a third, we combined this treatment with conservative amputation of the toe and the base slowly healed,

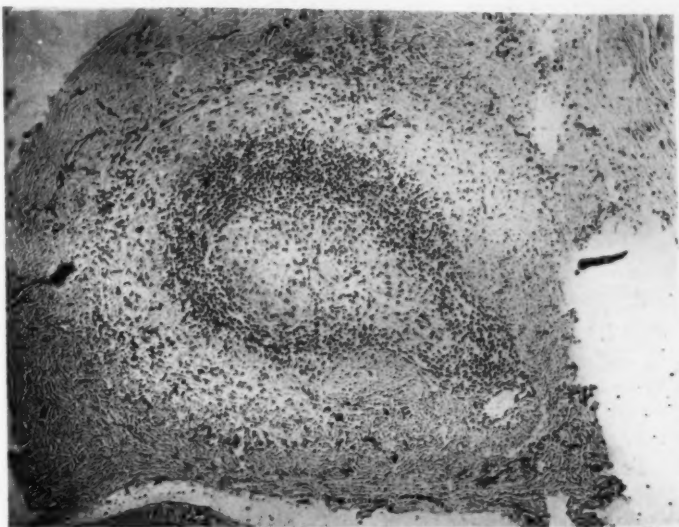


FIG. 16.—Case 3731. Artery on the periphery of a nerve  $\times 62$ , showing a complete obliteration with a process showing many lymphoid cells and a number of giant cells.

but we cannot be sure that duodenal flushing hastened the healing in this case.

We believe that baking for the improvement of circulation is dangerous,

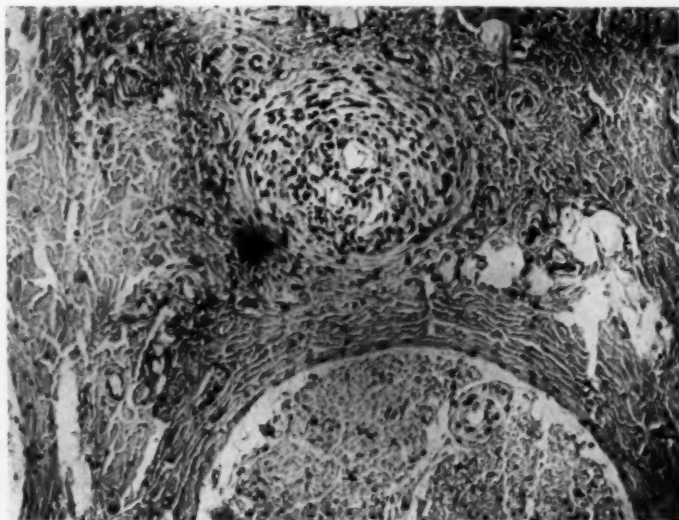


FIG. 17.—Case 3731. Small nutrient artery of a nerve  $\times 110$  (above), nerve fasciculus (below), showing complete obliteration and canalization of the artery. The small arteriole within the nerve fasciculus has a thickened wall.

for it may result in an acute flare-up of a secondary infection as it did in two of our cases. These required high amputation, which could not be closed by suture because of the certain contamination of the field.

We have not tried other forms of non-operative treatment in enough

cases to give us any real basis of judgment. They have not appeared to us to be reasonable. We strongly believe that, as is the case with many other diseases which normally have remissions, improvement under certain forms of



treatment have led some surgeons to a hasty advocacy of one or another form of treatment which the nature of the disease and its pathological processes condemns as irrational. Thus, section of the vasomotor nerves in the sheath of the femoral artery as recommended by Leriche<sup>4</sup> and others, while of definite value in vasomotor diseases such as Raynaud's syndrome and certain so-called trophic ulcers, cannot be expected to be of any value in this thrombotic disease. Anyone who has seen numbers of these patients coming into the hospital in such agony of pain that they cannot sleep and has seen them sitting up in bed all through the night rocking back and forth as they hold or press upon the affected part trying to relieve the pain even in some small measure, would welcome most heartily any conservative form of treatment other than a habit-forming narcotic that would relieve them of this fearful symptom. Section of the sensory nerves would do this, but has too many disadvantages to recommend it as a rational method of treatment.

*Case of Thrombo-angiitis Obliterans in a Female.*—In conclusion we would like to present briefly the single case which occurred in a female.

Hospital No. 859. Female aged forty-eight. Admitted October 5, 1921, on account of severe pain in right foot for five or six years, and ulceration of distal end of the foot three years. Five years before admission, the great toe received some sort of trauma. Following this the nail sloughed off and the wound took five months to heal while general pain in the foot continued. Two years later all of the toes became black and slowly separated. The bases have never healed over. Pain has been steadily increasing. *Past history* negative except that the feet were bound in childhood. No history of smoking.

*Physical Examination.*—Negative except for local condition. The right foot is small and is covered with tight skin. All of the toes are missing and there is a granulating ulcer in the region of the bases of the toes with a protrusion of the heads of the first and second metatarsal bones. Around the ulcer, the skin has the purplish color of gradually dying tissue. There is no sharp line of demarcation. The dorsalis pedis artery cannot be felt. The popliteal artery is palpable but there is less volume than on the other side. The urine is negative. The Wassermann reaction is negative. The X-ray showed decalcification of the bones but no osteomyelitis. The arteries were not visible. *Operation.* Amputation through the middle of the leg. *Subsequent course.* The wound edges became gangrenous and the tissue above became dusky. The wound opened. Staphylococcus aureus was cultured from the fluid. The wound gradually healed in three months. *Pathological examination.* An old obliterating thrombus was found in both the anterior and the posterior tibial arteries with secondary canalization. The dorsalis pedis had not only the old process but also evidence of a relatively more acute process, as shown by the presence of giant cells. A photomicrograph of the anterior tibial vessels is shown in Fig. 11.

#### SUMMARY AND CONCLUSIONS

1. Thrombo-angiitis obliterans is found extensively in China among the Chinese. Twenty-four cases in and around Peking present practically all of the pathological features of the disease which Buerger has described.

2. The process appears to be an inflammatory one, attacking the large and small arteries and veins in an irregular manner and causing thrombosis and obliteration. It is not necessarily progressive either from below upward or from above downward.



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3. The nutrient arteries of the nerves are frequently the site of this process. This may in some manner explain the severe pain which is constantly associated with this disease.

4. An extensive collateral circulation develops as a result of the blocking of blood-vessels as is shown by X-ray pictures of injected vessels. In some cases this collateral development can keep pace with the obliterating process and maintain the circulation. In other cases it cannot keep pace with it and then more or less extensive gangrene develops.

5. In those cases in which there is general and local evidence that the collateral circulation can keep pace with or outrun the obliterating process, and the gangrenous area is small, the treatment should be conservative operation. In the other cases the treatment should be radical operation. Only in borderline cases can conservative general treatment be expected to be of much avail.

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## THE ELIMINATION OF MORPHIN AND OTHER ACCESSORY DRUGS IN OPERATIONS UNDER LOCAL ANÆSTHESIA

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It was remarked by Dr. Otto Aagaard of Rovsing's Clinic, Copenhagen, in a personal interview, that he believed the pre-operative use of morphin protected the surgeon rather than the patient. Such a statement coming from one of his experience aroused my interest and I proceeded to investigate. Is the pre-operative use of morphin based on a fallacious theory, and if so, how are we to account for the widespread adoption of the procedure?

It is the routine procedure at one of the large mid-western clinics to give nearly every patient morphin, or morphin and scopolamin, preceding operation. The drug is omitted in certain instances, such as neurological cases, for obvious reasons. It was, and I believe still is, the custom in this clinic, and in many other institutions, to use 10 minims of adrenalin 1 to 1000 to every 100 c.c. of novocain, except in cases of toxic goitre or severe hypertension. Meeker states that 25 minims should be the maximum of adrenalin used in this strength. I have, however, frequently seen 25 to 40 minims used, in which cases 250 to 400 c.c. of  $\frac{1}{2}$  or 1 per cent. novocain was necessary to obtain anæsthesia. Such amounts often produced a more or less severe reaction, as would be expected. When such was the case, the reaction was superficially attributed to an individual idiosyncrasy to novocain, or to the fact that some of the drug had been injected into the circulation; but it is more probable that an overdose of adrenalin was the true cause.

Observations on three hundred cases in which operation was done under local anæsthesia, without morphin or adrenalin, convinced me that morphin as a pre-operative necessity was a fallacy. More recent observations on a series of 121 urologic cases\* at the Brady Foundation of the New York Hospital, in which, to insure the accuracy of the observations, I administered the anæsthesia personally, have afforded further convincing data. This group includes:

Nephrectomies .....	17	Epididymectomies .....	5
Pyelotomies .....	3	Varicocele .....	2
Nephropexies .....	1	External and internal urethrotomies ..	4
Perineal prostatectomies .....	26	Perineal drainage of prostatic abscess .	6
Suprapubic prostatectomies .....	3	Hydrocele .....	3
Cystotomies .....	35	Insertion of radium needles into prostate.	1
Bladder resections .....	2	Inguinal herniotomy .....	3
Orchidectomies .....	1		
			121

Neither morphin nor any other narcotic was used pre-operatively in this series. Adrenalin was routinely avoided, because of the toxicity of the

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\* Since the above was written, this series has been increased to 220.

solution, and for various other reasons which will be enumerated. In only four of the seventeen nephrectomies was it necessary to fortify the local anæsthesia with an analgesic, such as nitrous oxid or ether. In no instance was more than an ounce of ether required to carry on; and in no case was consciousness completely lost.

*Morphin.*—There is a group of patients, fortunately or unfortunately comprising the majority of human beings, who are so constructed psychically that they have a dread of operations, varying in degree from mild fear to collapse. If the administration of morphin, pre-operatively, eliminated or diminished this anxious emotional state, its use would be justified. It is my purpose to show that it does not. As Cushny has pointed out, "morphin acts as a depressant of the central nervous system, but while a constant pain is alleviated, a sudden shock causes almost as much pain as without morphin, and when a patient is once aroused, the sensitiveness apparently persists." It must be conceded that the mere approach to the operating table, the production of one or more dermal wheals, the manipulation in ascertaining landmarks for a nephrectomy, or any other operation, might thus arouse the patient, and keep him aroused. I have been impressed again and again with the fact that the patient who has received  $\frac{1}{4}$  or even  $\frac{1}{2}$  grain of morphin is just as sensitive to the production of the hypodermic wheal as is the patient who has no narcosis.

Other minor contra-indications to the use of morphin are the subsequent headache, not infrequently complained of, and the occasional nausea and vomiting, more often present during recovery from the drug. Morphin may also be responsible for urinary retention, because of temporary absence of sphincter reflex—an uncommon occurrence, yet an important one, particularly in urologic cases, in which forcing of fluids is so essential immediately after operation.

Occasionally following nephrectomy under local anæsthesia, a very mild intestinal distention has developed, but this has not lasted over twelve hours in any of our cases, and in many has been absent. Nevertheless we know that morphin slows peristalsis, and causes constipation. Depression of the respiration is also recognized as an important and constant action of morphin, a fact not to be forgotten in post-operative pneumonia. In the series reported, there has not been a case of post-operative pneumonia.

The place for morphin to play its part is post-operatively, when sensation returns with the subsidence of anæsthesia. In the series reported here, the anæsthesia lasted on an average of three and one-half hours. The return of sensation is gradual, but definite. This is the time that morphin can alleviate the constant pain subsequent to operation, and produce the pleasant brown study or the deep dreamless sleep. This is the true rôle of morphin; no other drug can replace it.

*Adrenalin.*—Adrenalin is used in solutions of novocain in local anæsthetic work for two reasons: to produce ischæmia, and to retard absorption of the anæsthetic and thereby prolong anæsthesia. The first is usually not neces-

sary. The second, from a clinical standpoint, is fallacious and absolutely unnecessary. In none of the cases has there been difficulty in controlling hemorrhage in the good old-fashioned way: by clamp and ligature. Hæmostasis has been rigidly attended to at the operating table. The patient is apt to bleed less post-operatively; the surgeon is sure to sleep better, if this simple procedure is followed. Adrenalin, as a means to ischæmia, may have a definite place in some types of surgery, such as operations on the eye, nose, and throat, and in special fields of neurologic surgery; but in general surgery, and particularly in urologic cases, its use is contra-indicated. Moreover, in cases complicated by cardiac disturbances, it has been observed to increase the irritability of the heart, and to produce fibrillary contractions. Nausea, vomiting, and collapse are toxic symptoms produced by the injection of amounts frequently used by some anæsthetists. We admit that adrenalin does produce an ischæmia for one-half to two hours, depending on the rapidity of absorption when injected locally, but novocain, properly introduced, will produce anæsthesia for an average of three and one-half hours, and often longer. Most operations can be done within an hour. Obviously, then, retardation of absorption of the anæsthetic is an unnecessary precaution.

A great number of urological cases, especially those requiring surgery of the prostate, are in patients over fifty. Our oldest patient was eighty-six. Many patients are arteriosclerotic to an extreme degree. There is often, following the administration of local anæsthesia, a marked rise in the arterial blood-pressure, accompanied at first by acceleration, then by slowing, and later again by acceleration of the heart rate. This no doubt is due to the introduction into the circulation of the adrenalin in the novocain solution, or to its too rapid absorption. Certain it is that any sudden change in the blood-pressure is undesirable in this class of patients. The lenticulostriate artery should not be insulted.

It is evident, therefore, that adrenalin is unnecessary in general surgery, because (1) hæmostasis can be more certainly and more safely obtained by ligature and clamp; (2) retardation of anæsthesia, due to ischæmia, is unnecessary, as the anæsthesia, if properly produced, will outlast the ischæmia; (3) it is contra-indicated for arteriosclerotic patients in the amounts used in major surgery; (4) it has been observed to increase the irritability of the heart, and (5) if administered in large amounts, toxic effects result.

*Accessory Analgesia.*—The most stoic and complacent patients will tell you after operation that it was a severe strain to go through the operation under local anæsthesia. The final decision as to whether any patient should be put to this ordeal must be based on that individual's psychic make-up and general condition, and on the clinical results previously obtained in similar cases. If the patient is so psychically upset, and there is a small percentage (3 per cent. in our series) who will not tolerate operation as long as consciousness is present, then it is necessary and wise to do both injecting and operation under a nitrous oxid analgesic, after the method of Crile.

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The question arises whether it were not better to do all operations under a nitrous oxid analgesic and a local novocain anæsthetic. In many types of major surgery this may be the nearly ideal procedure. However, the giving of any form of general anæsthetic is to be avoided in urological cases, except in the small group of hypersensitive patients already referred to. Any drug which may cause nausea, vomiting or respiratory depression is to be avoided, if possible.

In nearly all cases, a clever anæsthetist, and many who have given the question a thought, believe the female of the species to be better adapted, can engage the patient's attention by quiet conversation, or other means. It is remarkable how much can be accomplished in this manner, with both child and adult, as has often been demonstrated in our cases. The youngest patient in this series was six years old. It must always be remembered that the success of local anæsthesia depends not only on the anæsthetist, and the type of patient, but also on the close coöperation of the entire operating team. That the patient is conscious must be kept in mind at all times. Such remarks as "Pass me that sharp knife" are not apt to produce pleasant sensations. Thoughtfulness on the part of the operating team will in many instances remove the necessity for an accessory analgesia. We believe that failure to give attention to these details accounts for the fact that certain surgeons, accustomed to operating with the patient under general anæsthesia, consider local anæsthesia unsatisfactory.

The following points should be given consideration in the decision as to whether an accessory, such as a nitrous oxid analgesic, is necessary:

1. Does consciousness during the operation hamper the surgeon, and to what degree?
2. Does the benefit to the patient render the slight disadvantage to the surgeon negligible?
3. Is the mental strain to which the patient is subjected offset by a more rapid and uneventful convalescence?
4. Is mortality lowered by elimination of a general anæsthetic?

### SUMMARY

Observations on several hundred cases in which operation was performed under local anæsthesia, with and without the pre-operative use of morphin or adrenalin, indicate that the pre-operative administration of these drugs is not as beneficial to the patient as has been generally believed. This is particularly true in urological cases. Our investigation leads to the conclusion that in the majority of cases, local anæsthesia, properly administered, affords the patient the desired relief from pain, and the coöperation of the anæsthetist and the operating team will diminish mental anxiety. Therefore the patient should not, save in exceptional cases, be subjected to the possible untoward effects of accessory drugs.



TABLE I.  
Post-operative Data on Renal Cases Cited.

Case	Age	Administration of narcotics, hypnotics, etc.	Urinary output in first 24 hours	Catheterization (Time after op.)	Intestinal distention and treatment	Nausea, and vomiting	Elevation of		Size of kidneys removed (cm.)	Type of operation	Pathologic report.
							T.	P.			
1	41	Codein phosphate gr. $\frac{1}{4}$ , 3 hrs. and 6 hrs. after op.	400 c.c.	None	Slight; enema 1st 3 days; catharsis until 7th day	Once, 1st day	100°	100 to 108 1st 48 hrs		Pelviolithotomy	Renal calculi.
2	54	Codein phosphate gr. $\frac{1}{4}$ , 6.5 hrs. after operation. Morphin gr. $\frac{1}{6}$ , 13 hrs. after	1200 c.c.	None	None; enema for 3 days	Once, 1st and 3rd days	98°	80 to 104	15 x 10 x 7	Nephrectomy	Carcinoma.
3	62	Codein phosphate gr. $\frac{1}{4}$ , 6½ hrs. after	700 c.c.	None	None; catharsis on 2nd day	None	100° to 99° 1st 48 hrs.	80 to 100	14 x 9 x 7	Nephrectomy	Pyonephrosis.
4	30	Morphin gr. $\frac{1}{6}$ , 5 hrs. after; again 9 hrs. after. Codein gr. $\frac{1}{4}$ , 24 hrs. after	900 c.c.	None	None; catharsis every 3rd day for 6 days	None	101.2° to 100.4° 1st 48 hrs.	80 to 100	13 x 6 x 3.5	Nephrectomy	Renal tuberculosis.
5	44	Morphin gr. $\frac{1}{6}$ , 12 hrs. after; again 16 hrs. after	2820 c.c. syphon drainage	None	None; catharsis every 2nd day	Once, 1st day	100.4° to 101°	100 to 104		Pelviolithotomy	Renal calculi.
6	31	Codein gr. $\frac{1}{4}$ , 4½ hrs. after; again 8 hrs. after. Morphia gr. $\frac{1}{6}$ , 6 hrs. after	900 c.c.	None	Moderate; stupes to abdomen; pituitrin 1 c.c. amp. 24 and 36 hrs. after op.; enema twice daily, 3 days	Slight, 1st day	100° to 101°	66 to 120		Pelviolithotomy	Renal calculi.

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7	48	Morphin gr. $\frac{1}{6}$ , 4 hrs. after; codein $5\frac{1}{2}$ hrs. after	240 c.c.	None	None; enema 1st 3 days	Slight, 1st day	99° to 101.4°	90 to 120	10 x 6 x 5	Nephrectomy	Renal tubercu- losis.
8	26	Morphin gr. $\frac{1}{6}$ , 2 hrs. after opera- tion; 5 hrs. after, gr. $\frac{1}{6}$ ; co- dein gr. 1, 10 hrs. after	700 c.c.	None	None; usual post-operative enemas	None	100.6° to 102°	84 to 100	12 x 6 x 5	Nephrectomy	Pyonephrosis.
9	56	Morphin gr. $\frac{1}{6}$ , 6 hrs. after	840 c.c.	None	Slight; relieved by turpentine, stupes, and enemas	Slight, 2nd day	100° to 110	100 to 99°	14 x 8 x 8	Nephrectomy	Carcinoma of kidney.
10	57	Liberal opiates given in this case until the 4th day	400 c.c.	None	Slight; relieved by usual enemas and catharsis	Slight, 1st day	99.6° to 100.4°	96 to 100	14 x 8 x 6	Nephrectomy	Hydronephrosis with complete destruction of renal parenchyma.
11	54	Codein gr. 1, 4 and 10 hrs. after operation	660 c.c.	None	None; usual post-operative enemas	None	100° to 99°	100 to 112		Ureterolithotomy	Ureteral calculus.
12	39	Morphin gr. $\frac{1}{4}$ , 5 hrs. after operation	600 c.c.	None	None; usual post-operative enemas	None	99.2° to 100.8°	80 to 115	14 x 9 x 7	Nephrectomy	Renal tubercu- losis.
13	27	Morphin gr. $\frac{1}{6}$ , 6 hrs. after operation; codein gr. 1, 10 hrs. after	720 c.c.	None	None; usual post-operative enemas	None	99° to 100.4°	80 to 110	13 x 8 x 5.5	Nephrectomy	Renal tubercu- losis.
14	21	Liberal opiates 1st day	350 c.c.	None	Slight; usual post-operative enemas	None	98.6° to 100.6°	94 to 82	11.5 x 7 x 5	Nephrectomy	Renal tubercu- losis.
15	37	Liberal opiates 1st day	630-1st day 480-2nd day	1st and 2nd days	None; usual post-operative enemas	Slight, 1st day	100° to 100.8°	92 to 80	14 x 6 x 4	Nephrectomy	Pyonephrosis.

TABLE I—Continued.  
Post-operative Data on Renal Cases Cited.

Case	Age	Administration of narcotics, hypnotics, etc.	Urinary output in first 24 hours	Catheterization (Time after op.)	Intestinal distention and treatment	Nausea and vomiting	Elevation of		Size of kidneys removed (cm.)	Type of operation	Pathologic report.
							T.	P.			
16	54	Codein gr. 1, 4 hrs. after operation	360 c.c.	None	None; usual post-operative enemas	None	99.4° to 100°	100 to 112		Drainage	Perinephritic abscess.
17	55	Morphin gr. 1/6, 5 hrs. after operation; codein, gr. 1, 9 hrs. after operation	400 c.c.	None	None; usual post-operative enemas	None	100° to 98°	84 to 72	15 x 15 x 5	Nephrectomy	So-called "hypermephroma."
18	44	Morphin gr. 1/6, 5 hrs. after operation; codein 7 hrs. after; morphin gr. 1/6, 14 hrs. after	510 c.c.	None	None; usual post-operative enemas	None	100.8° to 100.4°	100 to 92		Nephropexy	
19	47	Morphin, gr. 1/6, 1 hr. and 4 hrs. after operation; codein, gr. 1, 7 hrs. and 10 hrs. after operation	390 c.c.	None	None; usual post-operative enemas	None	100.8° to 100°	108 to 94	14 x 5 x 4	Nephrectomy	Pyonephrosis.
20	42	Morphin, gr. 1/6, 2 hrs. after operation; codein gr. 1, 7 hrs. after operation	450 c.c.	None	Considerable for 4 days; pituitrin and frequent enemas	None	100.1° to 101°	120 to 100	11 x 6 x 5	Nephrectomy	Pyonephrosis

## MORPHIN IN LOCAL ANÆSTHESIA

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## POLYPOSIS OF THE APPENDIX VERMIFORMIS WITH INTUSSUSCEPTION OF THE APPENDIX

BY HARRY W. HORN, M.D.

OF WICHITA, KANS.

INTUSSUSCEPTION or invagination of the appendix, as a distinct entity and apart from the more common forms of intestinal intussusception, occurs very rarely. Polyposis of the appendix is perhaps more uncommon than intussusception of this structure. Association of a definite polypoid tumor or polypus of the appendix vermiformis, together with invagination or intussusception of the appendix into its own lumen without participation of the ileum or cæcum in the process of invagination, is unusual so far as may be determined from those cases that have found their way into the literature.

Intussusception of the appendix may be classed under the following groups:

1. Intussusception of the appendix may be associated with any extensive intestinal intussusception, such as the ileo-iliac, ileo-cæcal, or ileo-colic type. The appendix may be found invaginated as a part of the entire mass. In this type the condition is usually secondary to or a part of another process, the appendix bearing the normal relationship to the cæcum and thus cannot be considered as an intussusception of the appendix.

2. In this group may be found those cases in which the tip of the appendix may become invaginated into its own lumen, the process continuing to such an extent that a considerable portion of the appendix becomes invaginated and a true appendiculo-appendicular intussusception develops. If such a condition as this has ever been reported, I have found no record of it in the literature.

3. A third group occurs in which the intussusception begins at the junction of the cæcum and the appendix, the appendix inverting itself into the lumen of the cæcum to a greater or lesser degree without any participation on the part of the cæcum other than that of receiving the inverted appendix. This intussusception may be partial or complete.

4. The fourth group involves the same mechanical process as that which occurs in the third, but is associated with a tumor formation, usually a polyposis of the appendix; this undoubtedly acting as an etiological factor in bringing about the invagination of the appendix whether it be partial or complete. As an illustration of this group, I will relate the history of a case occurring in my own work.

### CASE REPORT

The patient, a widow, twenty-nine years of age, and an elevator operator by occupation, was admitted to the hospital, November 14, 1920. She is the mother of two children eight and ten years of age. Except for the usual diseases of childhood and her two pregnancies, her history is of no value except for the narrative of the present condition.



## POLYPOSIS OF APPENDIX WITH INTUSSUSCEPTION

Ten years ago, the patient was taken with severe colicky pains beginning in the epigastrium and radiating to the right lower quadrant of the abdomen. These pains would last from three to five minutes, suddenly ceasing and recurring in ten to fifteen minutes. The radiation of the pain was constant, always originating in the epigastrium and radiating to the right lower quadrant. There was no associated urinary disturbance, no vomiting, no bowel disturbance. There had never been any jaundice. After three or four days of this suffering, the attack would subside and she would have relief for three or four months.

In the interval between the attacks there were no digestive disturbances. During the attacks food neither intensified nor relieved the pain. There had been no loss of weight.

Since July preceding her admission to the hospital, the attacks have become more frequent and more severe in intensity. During the attacks of pain she could feel a mass the size of a small hen's egg in the right lower quadrant. This was very tender. After the pain subsided, the mass disappeared.

She was a well-nourished woman about 5 feet 5 inches in height, weighing about 130 pounds. There were no chest findings. Examination of the upper abdomen elicited no tenderness. In the right lower quadrant pressure was accompanied by tenderness, but not exquisitely so. Her last attack of pain had been three weeks before admission to the hospital. Palpation revealed a definite thickening the size of the examiner's thumb in the region of the cæcum. This moved laterally and was tender. The appendix could not be visualized on X-ray examination and the cæcum filled as did the rest of the colon. The stools contained no blood. Blood Wassermann was negative. Red blood count 4,800,000; white blood count 12,000; hæmoglobin 90 per cent. Temperature 99°. Urine was normal. A diagnosis of appendicitis was made and operation advised.

*Operation, November 17, 1920.*—Right rectus incision; the appendix could not be found. The cæcum was then delivered and from its inferior surface could be seen projecting the tip of the appendix. Unsuccessful efforts were made to reduce this invagination. A boggy mass could be felt within the cæcum. A longitudinal incision was made through the anterior longitudinal band of the cæcum to expose this mass. A polypoid mass 2.5 cm. in diameter was exposed at the site of the appendix from within. The centre of this mass was found to be the appendix, all but the tip of which had been invaginated into the cæcum. The appendix was then manipulated so as to be completely invaginated into the cæcum. The entire appendix was delivered within the bowel. The base of it was excised at its attachment to the cæcum. The appendix together with its mass was removed. The mucosa was separately sutured. The incision in the anterior wall of the cæcum was closed by three rows of sutures and a purse-string suture of linen was used to invaginate the serosa and the rest of the cæcal wall at the point from which the appendix had been excised. Palpation of the entire colon revealed no evidence of any

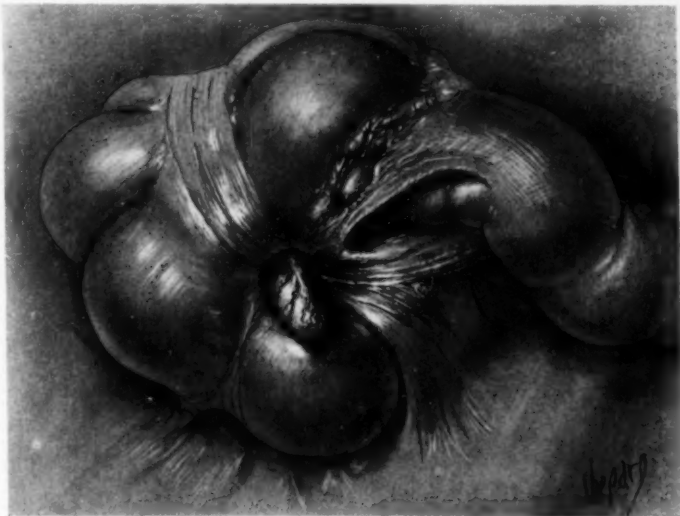


FIG. 1.—Shows appearance of invaginated appendix with its tip projecting from the cæcum.

further polypoid masses. The abdominal wound was closed after providing for drainage. The patient made an uneventful recovery and was discharged from the hospital December 12, 1920.

The appendix on removal was 12 cm. in length. The proximal 5 cm. presented a bulbous uniformly polypoid degeneration, the nodules of which varied in size from a pin point to a millet seed. At its base it was 3 cm. in diameter. This gradually diminished in diameter to .5 cm. where it terminated abruptly in the middle third of the appendix. This terminated just as abruptly at the appendiculo-cæcal attachment. The consistency was soft. A probe could be passed from the base to the tip of the appendix without obstruction. The mucosa of the distal portion of the appendix presented no gross changes or evidences of polypoid degeneration. The meso-appendix was markedly œdematous. The

ileo-cæcal glands presented no gross changes. The microscopical picture was that of a papillary adenoma with chronic inflammation of the stroma. No evidences of malignancy.

*Notes from Literature.*—Polypoidosis of the appendix is an uncommon finding. Smoler collected sixty-seven cases of intestinal adenomata, but none were found to be polypoid appendices. Kelly describes four cases of his own of polypoid formation in the appendix, but not associated with

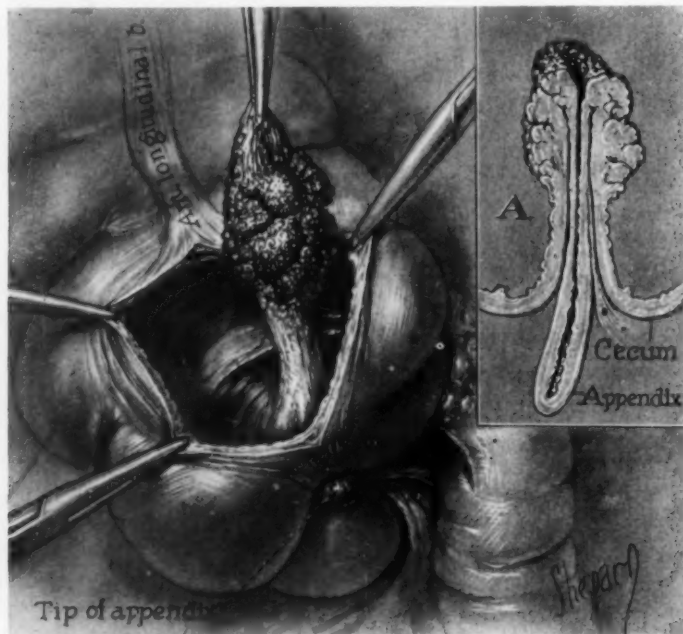


FIG. 2.—Showing the polyposis of the appendix as it appeared within the cæcum after incising the anterior wall. Inset shows a longitudinal section of the invaginated appendix and the polyposis.

intussusception of the appendix. Oberndorfer observed one case with a small pedunculated polyp situated in the middle of the appendix mucosa unassociated with any invagination. Vogel reports the case of a thirteen-year-old boy with symptoms of appendicitis extending over a period of several years. On removal of the appendix there was found at the junction of the middle and the distal thirds a polyp, the head of which was the size of a pea, its pedicle was 2 to 3 cm. in diameter. At the uppermost portion was a slight ulceration, no invagination.

Nothaas reports the case of a man seventy-two years of age, in whom at autopsy was found a polyposis of the appendix associated with incomplete intussusception of the appendix into the cæcum. Two other small polypi the size of a pea were found in the cæcum. This condition was accidentally found at autopsy and there was no history of any disturbance due to this condition occurring during the life of the patient. Moschowitz, Wallace and Langemak have each recorded cases in the literature in which the appendix only was invaginated without any participation of the cæcum and in which no associated polyposis or tumor formation was found.

## POLYPOSIS OF APPENDIX WITH INTUSSUSCEPTION

F. F. Burgheau has recorded a case of a male sixty years of age, who on examination was found to be suffering from a protrusion of the intestine the size of a fist, from the anal canal. Projecting from the centre of the protruding mass was a polypus the size of the distal phalanx of the thumb. A ligature was thrown around the base and the tumor excised. On attempting to replace the protruding mucous membrane, the condition was found to be an intussusception and not a prolapse. Examination of the removed tumor revealed it to be a completely invaginated appendix with a small papillomatous tumor springing from the mucous membrane, either just at or distal to the junction of the appendix with the cæcum. The abdomen was then opened and the intussusception attacked by the method of A. E. Barker. The patient died on the tenth day from bronchitis. No pathological report was noted.

Stewart Rouquette reports a case of a boy four years ten months of age, who had been operated ten days previously for ileo-cæcal intussusception. The appendix was reduced and removed, the stump was buried by two purse-string sutures. Nine days later obstructive symptoms developed. On the twelfth day following the first operation the abdomen

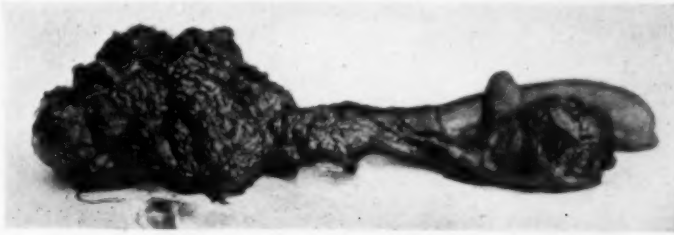


FIG. 3.—This photograph presents the condition of the appendix immediately after its removal.

was opened through a right rectus incision. The apex of the intussusception was felt at the splenic flexure, but the sensation experienced was so unusual that the presence of a "leading polyp" was suspected. Reduction was accomplished as far as the hepatic flexure. At this point difficulty in reduction was encountered and the mass was delivered and reduction attempted outside of the abdomen. Reduction was almost complete when the cæcal wall gave away and a polypoid tumor presented itself through the rent in the cæcal wall. From the lowest part of the cæcum there sprang a polypoid tumor almost pedunculated covered with granular mucous membrane and measuring three-fourths of an inch in diameter. This tumor corresponded to the exact site of the amputated appendix. The tumor was removed and the patient made an uneventful recovery. No pathological report of the tumor was reported. Blood was found in the stools.

Blaxland reports a case of a man sixty-three years of age, who had been ill for six weeks and for two days prior to his admission (April 3, 1920) to the hospital had been complaining of abdominal pain and vomiting—no blood in the stools. A right rectus incision was made and intussusception of the appendix was found, the apex of which was found in the middle third of the transverse colon. This contained a completely invaginated appendix. The intussusception was completely reduced with the exception of the appendix. An incision was made into the anterior wall of the cæcum and carried around to the base of the appendix, which was removed. The appendix was completely inverted. It was 4 inches long and  $1\frac{1}{2}$  inch at its base. The terminal inch of the appendix was "smooth white and bloodless." The mucous membrane over the rest of the organ was the seat of an extensive soft papillomatous growth, most evident at the cæcal orifice. The base of the appendix was surrounded for a quarter of an inch with healthy cæcal wall. The patient made an uneventful recovery. Microscopic diagnosis, malignant papilloma.

*Mechanism.*—Polypoid degeneration of the appendix was undoubtedly the etiological factor in this case in bringing about the intussusception of the

appendix. The polypus situated at the base of the appendix, as it increased in size, projected itself into the lumen of the cæcum in the path of least resistance. This doubtless exercised considerable traction on the appendix, and together with the peristaltic action of the cæcum and colon, the appendix became invaginated.

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# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

*Stated Meeting Held January 14, 1925*

The President, DR. EUGENE H. POOL, in the Chair

## RUPTURE OF THE BLADDER

DR. RODERICK V. GRACE presented a man, aged fifty years, who was admitted to Bellevue Hospital, September 18, 1923. Twelve hours before admission he had fallen down a flight of fifteen steps, following which he had suffered from severe pain in his left lumbar region and lower abdomen. He did not vomit, his bowels did not move, he had been unable to void urine. There was a contusion of the left lumbar region with very marked tenderness over this area. The bladder percussed and was felt to level of umbilicus. There was moderate tenderness over the suprapubic area. There was no abdominal rigidity.

Catheterization obtained 58 ounces of bloody urine. The abdominal tumor disappeared. The tenderness was diminished. There was no rigidity.

Twelve hours later, that is, 24 hours after accident, he was catheterized again and 22 ounces of bloody urine obtained. A third catheterization, 12 hours later, was done, and 22 ounces of bloody urine obtained.

Several hours after this, *i.e.*, 36 hours after trauma, he complained of sudden onset of very severe lower abdominal pain, most marked on right side. Examination showed lower abdominal tenderness and rigidity, most marked on right side just above pubis. A provisional diagnosis of ruptured viscus, probably bladder, was made, and the abdomen opened. About 2000 c.c. of slightly cloudy fluid was present in peritoneal cavity. It was odorless. In the dome of the bladder there was found an irregular laceration about 2 inches in length. The intestines showed slight redness, otherwise negative. A layer suture of bladder was done with plain and chromic gut. A good closure was obtained. The abdominal wall was sutured in layers.

Post-operative course: It was intended to catheterize the patient at intervals beginning 12 hours post-operative. However, he voided 19 ounces of urine spontaneously 12 hours post-operative. He voided at intervals on the succeeding days without any difficulty. His wound healed by primary union. Culture of peritoneal fluid was sterile.

Follow-up: Fourteen months, no symptoms. His wound healed firmly. Urinates two or three times daily, but none at night.

The reason for showing this case is the long interval following his injury before he showed signs of rupture of the bladder. It was first assumed, in view of his marked left lumbar tenderness, and the large amounts of bloody urine obtained by catheterization, that he suffered from a laceration of his left kidney. It is probable that for the 36 hours following his trauma that he had an incomplete rupture of his bladder involving all coats except the serosa, and that the repeated distention of the bladder finally resulted in the tearing of this coat.

DR. GEORGE WOOLSEY said that he read a paper ten or more years ago before the American Surgical Association, on three unusual cases of rupture



of the bladder, one of which resembled this case. That was the only one of the three in which there was injury. The man was asleep on a fire escape and fell off, landing on his buttocks. The rupture was extra-peritoneal, but there was a small amount of urine in the peritoneal cavity. Examination failed to disclose the point where the urine escaped into the peritoneal cavity, but this is not unique, for the speaker remembered reading at that time of two cases where rupture had been searched for and not found at all with urine in the peritoneal cavity. This man had only a small amount of urine in the peritoneal cavity. On account of the fact that it was impossible to be sure of the source of this urine, the cavity was drained for a short time and there was no further leakage. The other two cases were ruptured without known trauma, both in alcoholics.

#### IRREMOVABLE HIGH CERVICAL CORD GLIOMA. RADIO-THERAPY

DR. HAROLD NEUHOF presented a woman, twenty-seven years of age, who was operated upon in August, 1924. She came to the hospital for the relief of symptoms which had manifested themselves for three years; the onset had been with pain in neck and down both arms, paræsthesia of both arms, rigidity of neck. The history was progressive with periods in which the manifestations were not so severe. In July, 1924, she was suffering severe pain, apparently root pain; there was marked spasticity of the musculature of the neck. There were areas of hyperalgesia and other sensory disturbances referable to the upper cervical cord. There was weakness of the upper extremities, profound on the right side. There were atrophies in the shoulder girdles, in the right especially. The Queckenstedt test was negative. There was no incontinence until after lumbar puncture, when there was incontinence of both urine and fæces. The diagnosis rested between tumor of the upper cervical cord and pachymeningitis, the latter being considered because of the severity of the pain and the rigidity of the neck muscles. Laminectomy of the II, III, IV and V cervical vertebræ was done. Exposure of the upper cervical cord revealed a tumor on the right side of the cord opposite the second cervical segment; it was 2 cm. long, elevated from the cord, was covered by a network of veins and appeared to be sub-pial. Partial dissection disclosed the fact that the tumor arose from the substance of the cord. It seemed that any effort at removal of the tumor would result in a gross lesion to the cord, so a specimen only was removed, the report on which was glioma. Three weeks after operation radio-therapy was begun, and within four or five weeks improvement was noted. The improvement has been progressive and now the patient has free mobility of the neck, almost complete freedom from pain, good power in the left upper extremity and great improvement in power in the right. Doctor Neuhof called attention to the patient's complete freedom of movement of the head and the degree of power existing in the upper extremities, full power of flexion and extension and hand grasp, and the approximately normal gait. He believed that to call this a state of remission, in explanation of her present condition, would be a mistake, as there could be no reason to expect remission in this case.

DR. JOHN A. HARTWELL recalled a case seen by him in Bellevue Hospital which showed the efficacy of radiation in glioma. He was not very enthusiastic about radiation in malignant tumors, but in this case there was so striking an improvement that it looked as if in that particular type of neoplasm

## FASCIAL STRIP REPAIR OF FEMALE HERNIA

it is effective. The man presented himself with a tumor in the post-central portion of the brain. It was a glioma 3 inches in diameter and directly under the dura, and by exposing the brain this large mass of partially destroyed tumor presented itself and was removed to such extent as possible, leaving a good portion of the tumor behind. He was submitted to X-ray treatments which continued for two and one-half years after operation, when the symptoms had decreased and he could work to some extent and walk with some ease, notwithstanding that a good part of the motor part of the brain was destroyed. There was no evidence that the growth had recurred. There was still a depression in that part of the skull. Whether those results occur in the majority of gliomata the speaker did not know, but in this instance it was very striking and lasted over a considerable period.

DOCTOR NEUHOF, in closing the discussion, said that the question of the late result was, of course, the crux of the whole matter. It was not intended that the case presented should be interpreted as one of cure or even prolonged relief. In the case of a glioma of the brain it is known that the tumor may increase in size without any objective evidence of such increase. The interpretation of any temporary effect of radiation is, therefore, very difficult in glioma involving the brain. The conditions are different in cord glioma where more manifestations appear with increase of the tumor. Hence, it is fair in this case to indicate that there may be a definite relation between the radiotherapy that was employed and the improvement noted.

## FASCIAL STRIP REPAIR OF FEMORAL HERNIA

DR. HUGH AUCHINCLOSS presented a woman, twenty-six years of age, married five years; two children living and well; miscarriage two years ago after lifting a heavy piece of marble. A few days later a lump was noticed in the right groin. She wore a truss for one year. The hernia was never strangulated nor incarcerated nor particularly painful except just before menses. It was smaller when lying down and larger when standing. The patient weighed 140 pounds. Local examination revealed the typical appearance of a complete right femoral hernia.

Repair in this case was done as follows: An oblique incision just above Poupart's ligament was made, Scarpa's fascia divided in the thigh, and the sac freed and opened vertically to Poupart's ligament. The external aponeurosis was then opened to the upper part of the external ring. A long fascial strip about 1 cm. broad was split off from the upper cut edge, leaving its lower end, really the inner pillar of the external ring, attached. The neck of the sac was exposed after ligating the obturator vessels and peritoneum and incised vertically well down to Poupart's ligament. The contents were reduced and the redundant sac below the ligament cut away. The posterior cut edge of the sac below the ligament was then passed up by means of a curved clamp through the crural canal into the abdomen and the peritoneal incision closed as in an ordinary laparotomy repair. Cooper's ligament and the femoral vein were thus readily exposed, and the repair begun. By means of a scissor clamp type of instrument, it was a very simple procedure to draw the fascial strip through the triangular fascia, the conjoined tendon, under Cooper's ligament and then through the shelving margin of Poupart's ligament. Passing it under Cooper's ligament to Poupart's ligament, he repeated, was very easy to do, and could be done with a control and precision that sewing with

a needle on the end of a needle holder does not afford. There was no alarm felt about wounding the vein in spite of the fact that the strip was brought through the ligaments in close relationship to it. When through, there was no tension noticeable, and the crural canal was thoroughly blocked by the passage of the strip to and fro between the ligaments. The end of the strip was passed through the shelving margin of Poupart's ligament a couple of times, and a few fine chromic sutures used to maintain it. The wound was then closed.

The needles used for fascial sutures were present at the operation, but when introduced into the wound it would have been well nigh impossible to use them in accomplishing what was very easily accomplished by this type of clamp. Indeed, a finely pointed mosquito clamp can be used, but the cutting edges on the outside of these clamps provide a slit in dense fascial structures, considerably facilitating delicacy in technic.

The reasons for citing this case are: 1. Femoral hernias do recur even though treated by accepted methods. 2. If the operation be carried on above Poupart's ligament, a strip of the external oblique can be used for repair with equal ease, a sense of greater security, less danger of accident to the vein and with probably less chance of recurrence than a suture. 3. An instrument for suturing with fascial strips greatly facilitated the procedure. 4. This instrument is useful in any fascial suture, or tendon transplantation operation.

During the past few years the reporter had seen three femoral hernia recurrences. They were operated on by different surgeons, one by himself. It had always been his impression that the results of femoral hernia repair, by whatever method used, were nearly 100 per cent. successful. This may not be true. There is a little feeling of dissatisfaction while operating on a femoral hernia solely from below Poupart's ligament. One might say that one's operative style is somewhat cramped. It isn't always easy to free the neck of the sac and draw it down, nor to draw down the contents. When reduced, it is not always certain that the reduced contents have not a lesion of some importance at or just above the point of constriction that one should observe after reduction. Once reduced, the chance to look is lost. The obturator vessels do run close to and anterior to the neck of the sac very frequently, and they together with the femoral vein on the outside, exert restraining influences. Cooper's ligament is pretty high up and the pectineal fascia does split at times.

All these facts are too well known to require more than passing mention. The writer still does believe that but few femoral hernias do recur, but he is not so certain just precisely why this is.

DR. SEWARD ERDMAN remarked that the operation had been performed through the inguinal canal above Poupart's ligament after the method described by Ruggi in 1892 and later popularized in this country by Moschcowitz.

In the speaker's experience on the Second Surgical Division of the New York Hospital, there had been a much larger percentage of recurrences after the high operation than after the much simpler and more popular methods of operation from below.

As for difficulty in getting the sac down sufficiently for a high closure,

## FASCIAL STRIP REPAIR OF FEMALE HERNIA

as indicated by Doctor Auchincloss, the speaker had found it possible to overcome this objection by twisting the neck of the sac several turns which not only frees it from the adventitious tissues surrounding it, but readily permits its transfixion and ligation at a high level.

DR. WILLIAM B. COLEY said that Doctor Erdman had expressed his own view concerning the inguinal method of approach for femoral hernia. Nearly every year, for many years, in his review of the literature on hernia for *Progressive Medicine*, Doctor Coley has been obliged to discuss some new method of operating on femoral hernia by the inguinal route. None of these methods has been adopted at the Hospital for Ruptured and Crippled for the reason that such very satisfactory and durable results have been obtained by the femoral route, which has been employed there for more than thirty years. This method consists of an oblique incision just below Poupart's ligament; then the sac, which has been freed from all adhesions, is dissected high up in the femoral canal (with a little care, this can always be accomplished). If the sac is properly freed, and the contents reduced, and the ligature is placed sufficiently high and tied, the stump of the sac is reduced in the abdominal cavity, and there is no longer any funicular process left behind that might favor a recurrence of the hernia. For the closure of the femoral opening sac, Doctor Coley always uses a purse-string suture of medium size kangaroo tendon which is first passed through the inner portion of the roof of the canal above and then through the pectineal fascia and muscles below, emerging about one-quarter of an inch from its original entrance. When this suture is tied, the floor and the roof of the femoral canal are brought into apposition and the femoral opening is completely obliterated. Ninety-six per cent. of the cases thus treated at the Hospital for Ruptured and Crippled have remained well. Doctor Coley believes that this method can be successfully carried out even in very large hernias. If one should meet with a case in which the opening was so large that it seemed doubtful that a cure could be accomplished by this method—Doctor Coley has never seen such a case—then he believes that the Gallie method of utilizing fascia sutures from the thigh might be employed in preference to the McArthur method of utilizing fascia strips from the external oblique. Doctor Coley stated that they had never used the Gallie method of operation for femoral hernia but, rather, had limited its use, in accordance with Doctor Gallie's practice, to cases of large direct hernia and recurrent hernia. During the last eleven months at the Hospital for Ruptured and Crippled, fifty-one operations, according to the Gallie method, have been performed on Doctor Coley's service. So far, in only three cases has a recurrence been noted, and these were all large recurrent hernias. There have been no recurrences noted in the primary cases. In one case in which the Gallie method had been used, a young man with a large ventral hernia occurring after prolonged suppuration following an operation for removal of the gall-bladder, a successful closure was accomplished, which would not have been the result had any other method been employed. McArthur was the first to utilize strips



of fascia from the external oblique for suture material. This method was first brought out in the *Journal of the American Medical Association*, October 8, 1904. However, Doctor Coley believed that the type of cases in which the Gallie method was indicated (large direct, and large recurrent hernias) precluded the use of the McArthur method for the reason that so many sutures would be required that at least two inches of the external oblique fascia would have to be sacrificed for suture material, thus seriously weakening the abdominal wall and certainly preventing any overlapping of the fascia. The latter step, which has so long been advocated by Andrews, is often a great aid in securing a firm closure in the more difficult cases.

DR. HENRY H. M. LYLE was thoroughly in accord with what Doctor Erdman had said regarding the value of the femoral route for repairing simple femoral herniæ; but in contrast he wished to emphasize that in incarcerated and strangulated herniæ the inguinal approach is the route of choice. The possibility of intestinal damage makes it absolutely necessary to know the condition of the gut and to be able to repair any damage that may be present.

In discussing the value of Gallie's operation, he called attention to McArthur's method of autoplasmic suture in hernia and reminded the Society that his first communication was reported in the *Journal of American Medical Association*, November 2, 1901, almost twenty-four years ago. McArthur used pedicle fascia grafts taken from the edges of the incision of the external oblique. He showed that these fascial sutures healed *in situ*, were not absorbed, did not slough, but lived and became intimately incorporated as living strands of white connective tissue. A little over two years ago Doctor Lyle began using the Gallie and McArthur methods for closure of recurrent and large direct herniæ. Both methods gave excellent results. In suitable cases, he learned that the McArthur method gave as satisfactory a result as the Gallie and was much more simple. He reserved the Gallie procedure for those cases in which the fascia had to be transplanted from a distance. To date he has done seventy-three cases without any recurrences. At first only the recurrent and difficult direct herniæ were repaired by this method. Since the first of the year he has adopted it as his routine method of suture. Among the seventy-three cases, eight cases are double recurrences, three are triple recurrences on one side and double on the other. They have all been workmen. The results obtained to date have been more satisfactory than in those cases treated by ordinary suture. It is his intention to report the results after a sufficient time has elapsed.

The method is based on sound physiological principles. Seelig's studies show that the union obtained by ordinary suture of white fibrous tissue is not satisfactory, while that of fascia to fascia is intimate. Studying the manner in which a tendon unites to a muscle, one finds that the tendinous fibres unite with the intermuscular connective tissue and these with the finer subdivisions throughout the muscle, the result being an anchorage by innumerable fine roots. In the same way the fascial grafts unite directly with Poupart's and



## SYPHILIS OF THE STOMACH

with the intermuscular connective tissue of the muscle and form living roots anchoring it firmly into the tissue. In other words, it is a physiological suture.

DR. HAROLD NEUHOF said that any type of pedicle graft always approaches more nearly the ideal than any form of free graft. The method employed by Doctor Auchincloss, therefore, in his case having proved adequate, was unquestionably better than a free graft with its greater chance of failure. There are, however, instances in which free grafts must be employed, especially where the tissue in the field itself cannot be employed. This is particularly the case in large, direct, recurrent herniæ. The use of fascial strips as a basket weave has recently had wide application and good results have been reported. The speaker believed, however, that these strips would tend to undergo early degeneration because of undue tension, and still thinks that the use of sheets of fascia is more logical. After the field has been prepared a sheet of fascia lata is removed from near the knee and in a typical case is attached above to the margin of the external oblique and below to the reflected surface of Poupart's ligament. A notch in the graft is made for the passage of the structures of the cord. The graft is sutured snugly in place but not under tension. Excellent end results have been seen after the use of this method.

DOCTOR AUCHINCLOSS said he wanted to add only one thing. He was aware that using a fascial strip in the repair of hernia had been often done and he had not intended to present this as an original procedure. The point he wished to bring out was that it is not easy with femoral hernia to introduce a fascial strip, using the Gallie needle with its large sized eye without using some force to get it through the aponeurotic structure. The clamp facilitated this step. He would recommend trying such a clamp to anyone interested in using fascial sutures through dense scar tissue, wherever the place may be, and in tendon transplantation operations. He did not favor using fascial sutures as a routine in hernial operations in general, but in selected cases believed it to be the most reliable method yet described.

## SYPHILIS OF THE STOMACH

DR. JOHN A. HARTWELL read a paper with the above title, for which see page 767.

DR. NATHAN W. GREEN said that in the *American Journal of Roentgenology* for April, 1921, Dr. L. T. LeWald reported some cases called "leather bottle stomach," in which he thought some were syphilis of the stomach. In that series was a case of the speaker's which was operated upon by him at St. Luke's Hospital, in which a biopsy was obtained which proved it to be cancer. The patient had given a negative Wassermann reaction. The case simulated what one had been accustomed to consider syphilis of the stomach.

Doctor Green believed time and the therapeutic test and the biopsy were the only means of making certain the diagnosis; and Doctor Hartwell had cut these down to the biopsy, which the speaker thought was quite proper

from a purely scientific standpoint. He further stated that he thought some cases might appear to give the röntgenogram supposed to be characteristic of syphilis of the stomach which might later turn out to be carcinomata. On the other hand, we were dependent on time, the history and a biopsy in many cases appearing typical of carcinoma of the stomach to confirm such a diagnosis. Because the patient happened to present a positive Wassermann reaction, one was not always justified in making the diagnosis of syphilis of the stomach given the X-ray picture showed a prepyloric filling defect pointing in that direction. It was generally conceded that a positive Wassermann might frequently be present in cancer of the stomach. Constitutional syphilis and cancer of the stomach might, and he believed frequently did, occur in the same patient, just as tuberculosis and cancer might be present together.

Doctor Green said in looking up the records in two of the hospitals with which he was connected, he had been interested to see the very small percentage of cases of syphilis of the stomach recorded. At the Memorial Hospital where he had been in charge of the Stomach Service for three years, from a search by the chief record clerk he could find not one case of syphilis of the stomach since 1920. That was four years. Of course at this institution a certain percentage of the cases referred had been through the hands of many specialists, and it was possible that they had been filtered out. At the City Hospital where there were a thousand beds and where there was a large autopsy service, the record of syphilis of the stomach was exceedingly small.

From a personal communication by Doctor Cornwall, Pathologist to the City Hospital, he had selected the following facts:

In the records which he had hurriedly looked up for him, he was unable to find a case recorded. But from his memory, which extended over a period of twelve years from the time he was first conversant with the Autopsy Service of the City Hospital and Metropolitan Hospital, beginning with the time Dr. John Larkin took the pathologist's position, about 1912, he could only recall one case. According to his reckoning that was only one case in approximately 6000 autopsies. In addition to this one case he recalled two surgical specimens diagnosed as syphilis of the stomach from the Metropolitan Hospital. No surgical biopsies of this condition were obtained at the City Hospital.

DR. CHARLES GORDON HEYD said that in July, 1923, there came to the Post-graduate Hospital a man of forty-six years of age with a history of belching gas for nine months. Seven years before the patient had had paralysis for six weeks and had been treated for tuberculosis of the spine and recovered. The patient's complaint of distress became progressively worse, so that he resorted to vomiting after every meal, and one week previous to his admission to the hospital was unable to retain anything except water. Upon his admission to the hospital he was emaciated, but had a fairly good color. There was a mass in the abdomen which was thought to be carcinoma of the stomach. The operative findings are of great interest in that I made

## SYPHILIS OF THE STOMACH

a diagnosis of luetic liver, but thought that the mass in the stomach was carcinoma. The operative findings were as follows:

An infiltrating, medullary carcinoma involving the terminal portion of stomach and pylorus. Pyloric passage admits a quill only. Stomach slightly dilated, containing coarse food fibres, peas, bismuth and broken-down vegetative material. The glands along the greater curvature were enlarged but seemed hyperplastic rather than neoplastic. No glands along the lesser curvature except just at the pyloric juncture. Pancreas was negative. Mesocolon was negative. Liver showed many scars with considerable fibrosis, suggesting an old luetic liver rather than a hypertrophic cirrhotic type. Appendix was not exposed. Remainder of abdomen negative. Resection was done. The later pathological report was as follows: Gross: Specimen is pyloric end of stomach, 40 mm. along the lesser curvature and 100 mm. along the greater curvature. The lumen is 20 mm. in diameter at the smaller end. On section there is an irregularly outlined ulcer approximately 30 x 13 mm. in area extending upward along the greater curvature from the pylorus. This ulcer is rather shallow. Its base is fairly firm. The muscle and fibrous tissue beneath the ulcer is 13 mm. thick. In the omentum there are small firm spots, apparently lymph-nodes. The largest lymph-node is about 18 mm. in diameter. It appears negative. Microscopic: Sections through ulcer show rather dense fibrous tissue in which there are numerous fairly well-defined lymph follicles. The underlying muscle is diffusely infiltrated with round cells. In the mucous membrane on the stomach side of the ulcer there is a very marked increase of fibroblastic cells and numerous well-defined minute nodes of epithelioid cells containing occasional multinucleated giant cells. These nodes are surrounded by abundant closely packed plasma cells in a fibroblastic stroma. In some places polymorphonuclear leucocytes are very abundant in the stroma also. The muscle beneath this layer is richly infiltrated with round cells and some of the small nodes are highly suggestive of tubercles, but the abundant plasma cells adjacent to them speak strongly against a diagnosis of tuberculosis and in favor of syphilitic granuloma. Careful study of the sections has so far failed to find any carcinoma. Further sections are being prepared in order to search for malignant areas. The principle part of the ulceration, however, would appear to be due to the granulomatous condition. Sections of all three lymph-nodes show only chronic inflammation. Diagnosis: Ulcerated chronic granuloma of pylorus, apparently tertiary syphilitic lesion.

DR. JOHN DOUGLAS said that about ten years ago he showed a case before the Surgical Society on which he had operated at Bellevue Hospital, an elderly man who had a mass, absence of free HCl and an X-ray indicative of carcinoma. Doctor Douglas resected one-third to one-half of the stomach and sent it to the laboratory and got a report that there was no carcinoma of the stomach, but he could not remember the exact nature of the pathological report. Evidently the case was not recorded at Bellevue as syphilis, according to Doctor Hartwell's statement. It had been his impression all these years that his case was a matter of record, and was a real case of syphilis of the stomach, the patient having a 4+ Wassermann and having been treated for syphilis before and for two years after operation, when he was lost track

of. Also, the mass removed in the gross did not resemble in any way the usual pyloric ulcer, and clinically was believed to be a syphilitic lesion.

DR. EUGENE H. POOL said recently at a pathological conference syphilitic lesions of the stomach were discussed. Doctor Elser said that in lesions of tertiary syphilis the diagnosis from histological data alone was presumptive and not conclusive. Such features as endothelial swelling, increased plasma cells and shadow-like cell outlines indicating the death of cells and slow disintegration, are suggestive but not positive of syphilis. The spirochæte is found with great difficulty and uncertainty even with the Levadite silver stain in tertiary lesions. These features indicate why so much uncertainty attends the acceptance of syphilitic lesions of the stomach in many cases cited in the literature. Assuming that gumma occurs at times as the initial step in gastric ulcer formation, after the gumma breaks down there must be a bacterial invasion and action upon the wall of the ulcer by the gastric secretion. Thus the ulceration becomes increased and its syphilitic characteristics are lost, so there is additional difficulty in proving such a case is syphilitic. Most of these ulcers therefore must be presumptive and not conclusively syphilitic.

DR. ROBERT T. MORRIS said that a change in the endothelial cells may lead to a mistake in diagnosis in the laboratory as well as clinically. In one of his cases he had operated for pyloric "cancer" with obstruction, with no idea of bringing about a cure. He did a gastro-enterostomy for the relief of symptoms and the patient had X-ray treatment subsequently, and became completely well. There had been a large tumor mass and the pathologist reported endothelioma. When the question of syphilis came up at a later date, Doctor Morris had tried to follow up this case, but was unable to find the patient. Probably this case was one of gumma mistaken for endothelioma and the gumma disappeared under X-ray treatment, as it is known to do at times. Doctor Hartwell's paper had been so carefully prepared that the speaker had obtained a great deal of information from it.

DOCTOR HARTWELL, in closing the discussion, said that Doctor Pool had pointed out the essential thing. Everyone knows that the pathologist is loath to make a diagnosis of syphilis from specimens sent to him, even though clinical evidence is overwhelming. If he cannot find the spirochætae he is not willing to say positively that the lesion is syphilis in very many instances. But there are many significant changes to be observed, and where a gumma is found, it seems evident that certain cases, such as the one reported by Doctor Heyd from the Post-graduate Hospital, are almost certainly syphilis. On the other hand, the rarity of syphilis of the stomach has been lost sight of by such writers as Castrex and Mariano, who make the surprising statement that all ulcers of the stomach are syphilitic; Ewald—who quotes Lang and Engel as assigning this cause to 20 per cent. and 10 per cent., respectively, and Fenwick who places the proportion at 5 per cent.

There occur throughout the literature statements that one should be most



## MEDIO-LATERAL ARTHROTOMY FOR KNEE-JOINT DISTURBANCE

guarded against making a diagnosis of syphilis, and yet many of those making these statements report large number of cases under the caption "Syphilis of the Stomach," on very doubtful evidence. It seems, therefore, desirable to bring the situation to your attention as most of the members of this Society are teachers, and the closing remarks of the paper summarizing what appears in one of our text-books, explain the purpose of the paper. It is regrettable that students should have text-books containing such misleading teaching in their hands. The speaker concluded by thanking the members for their attention and for the discussion.

*Stated Meeting Held January 28, 1925*

The President, DR. EUGENE H. POOL, in the Chair

## MEDIO-LATERAL ARTHROTOMY FOR KNEE-JOINT DISTURBANCE

DR. JOHN J. MOORHEAD presented a woman, twenty-six years of age, who injured her left knee in February, 1923, while wrestling. Joint immediately became painfully swollen with maximum tenderness in the neighborhood of the internal condyle. Under rest and the use of a plaster-of-Paris bandage the condition subsided after three months, but the joint remained persistently weak and insecure. In August, 1923, had a similar attack of painful swelling following slight violence and when seen in September, 1923, the joint was swollen, could be bent only to a right angle, extension was somewhat limited and there was complaint of tenderness on the inner side. No loose body could be made out and the region of the internal semilunar and about same was locally tender. At the Post-graduate Hospital on October 1, 1923, a medio-lateral arthrotomy was performed, this being the first patient in whom the speaker had performed this operation, hitherto approach to the joint being gained through the Jones patella split incision. This medio-lateral incision begins about two inches above the top of the patella, passes down to the top of the same, and then goes around the inner margin of the patella and then toward the tubercle of the tibia. After the joint is open, the entire patella can be displaced to the outer side, giving almost as good an exposure as the patella split incision, but without the necessity of sawing the bone. The "hands-off" technic was rigidly employed throughout.

The findings consisted of a fracture, a displaced internal semilunar cartilage, numerous adhesions of the upper part of the quadriceps pouch, villous thickening of the synovia and some thickened subpatella fat pads. This debris was excised before closure; the joint was irrigated with ether, which is part of the technic.

After operation no splintage was employed, but the patient was enjoined to move the joint every two hours for the first two days, from 8 A.M. to 8 P.M., throughout two round trips of motion, that is, to and from a right angle.

She was discharged from the hospital on October 10 and at that time could bend the knee to about a right angle. In the interval since operation, she has continued to have practically perfect use of the joint, except for a slight attack of synovitis in April, 1924, when she wrenched the joint. She has now perfect function of the joint and she engages in all forms of exercise.

Patient is presented one year and three months after operation because she was the first in whom this type of operation superceded the Jones patella



split, and she is shown also to indicate the extent of the scar and as a contrast to the next similar case which was done a month ago.

DOCTOR MOORHEAD presented a second case, a man twenty-eight years of age, a conductor, who wrenched his left knee on July 22, 1924. This was followed by swelling and pain, but he continued to work for three hours. He then went home but returned to work again. Two weeks later the continued pain and swelling compelled him to stop work. On November 21 he was seen by Doctor Moorhead and examination revealed marked crackling of the joint, audible on certain motions, more marked on lateral motion; some fluid; tenderness over the inner margin, especially in the region of the internal semilunar; no loose bodies. Operation was done on December 22, a medio-lateral arthrotomy with ether irrigation of the joint, and he walked on the fifth day, leaving the hospital on December 31. The findings were similar to those in the preceding case, but in neither of these patients was the semilunar the sole cause of the joint difficulty. Post-operatively, he carried out the active motion program prescribed for the other patient. At the present time the knee is weak on going up and down stairs; the patella rocks forward and the foot has to be put down evenly. There is still some swelling, but the scar is non-adherent, there is no longer any crepitus, lateral motion is yet marked and he can bend the knee well beyond the right ankle. There is a slight limp. Excessive lateral motion is probably due to capsular stretching.

Ether irrigations are used in these joint and bone cases to wash out clots of blood because of its stimulatory action and because it leaves no residue as saline and other solutions do. It gives a mild reaction. This medio-lateral exposure gives all the advantages of the former patella split and is better because it does not involve any bone. Thus far it has not resulted in any permanent bad effects.

DR. ROYAL WHITMAN said that for opening the knee-joint, in his own practise the incision was but two or three inches in length, the semilunar cartilage was divided into two sections, and when the attachments had been divided with a tenotome the two halves could be easily removed with a little traction. In this type of operation there was but little injury to the joint and therefore less danger of functional disturbance than when the long incision and patella displacement was employed. He doubted the advisability of insisting on the immediate resumption of motion before the incision in the skin and joint structure could have united. He thought, on the contrary, that what might be called physical rest during the immediate period of repair would lessen rather than increase the tendency to the formation of adhesions.

DOCTOR MOORHEAD replied that he would not have made the long incision if the diagnosis had been perfectly clear. In reference to early mobilization, unless he instituted this within the first forty-eight hours, it had been his experience that he was quite likely to get post-operative adhesions which would defeat his object of mobilizing the joint. In actual practice, early post-operative mobilization of these joint cases seemed to give better end results than partial or incomplete mobilization.

#### ACUTE YELLOW ATROPHY OF LIVER

DR. ALLEN O. WHIPPLE presented a woman, twenty-nine years of age, who gave a negative history save for good health up to October, 1922, when she began to have failing appetite. In December, 1922, she contracted a

## ACUTE YELLOW ATROPHY OF LIVER

severe cold and the middle of January, 1923, she developed severe nausea and vomiting, with loss of weight and very severe constipation. She very soon developed jaundice which continued to increase up to the time of her first admission to the Presbyterian Hospital, January 23, 1923. Examination then showed a well developed, fairly nourished young woman, moderately jaundiced in scleræ and skin. Lungs and heart negative. Blood-pressure, 115/60. Marked tenderness over right upper quadrant, along costal margin and over right lobe of the liver. Temperature normal, blood count normal. Wassermann negative. Bile in urine, none in stools. Liver function test showed marked retention of dye. She grew steadily worse for ten days.

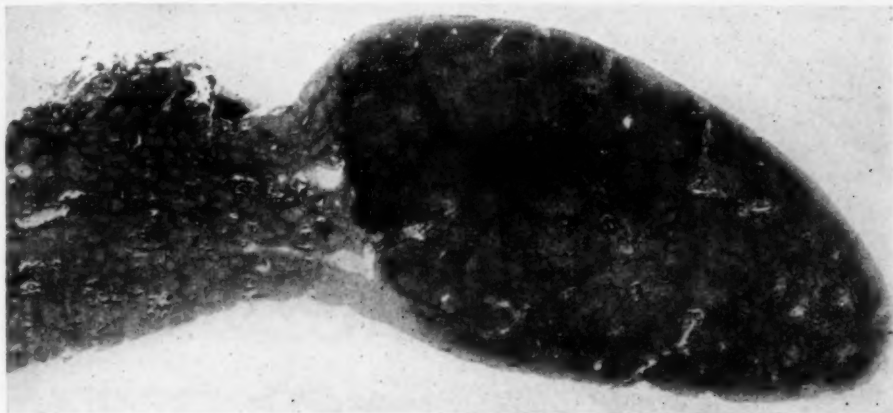


FIG. 1.—Low power photomicrograph of section removed at operation.

Jaundice, anorexia, nausea and vomiting, liver enlargement and tenderness, foul breath, constipation and depression, to dulness bordering on stupor were progressive and striking features. As these symptoms subsided, her mental state changed to a melancholia. She then slowly improved for five weeks, when she had a relapse with marked anorexia, decrease in size of the liver with development of pain in right trapezius as well as along right costal margin. Melancholia continued. At her own request she was discharged in March, hoping a change in environment might help her psychically.

Following her return to her home she had almost constant aching pain along right costal margin with exacerbations when the pain radiated to the right shoulder. In December, 1923, her appetite began again to fail, she became obstipated, pain and tenderness in right upper quadrant grew worse, and she developed asthenia. In January, she had several attacks of hæmaturia with stinging, burning micturition. She was readmitted to the Medical Service on January 16, 1924.

Examination showed no jaundice, marked hyperæsthesia of entire right side of abdomen and chest. Liver dulness began at fifth rib, tender edge was felt 7 cm. below costal margin. Tender spleen was just palpable. Normal blood. Urine negative for bile or red blood corpuscles. Stool contained bile.

Liver function, 1924—after 15 minutes 16 per cent. of dye in serum, 60 minutes 12 per cent. retained. 1923—after 15 minutes 17 per cent. of dye in serum, 60 minutes 18 per cent. retained. Temperature normal. Bowels obstipated for nine days in spite of all kinds of catharsis. She was seen in consultation and it was decided that possibly the biliary tract was the source of infection. Operation February 1, 1924. Cholecystostomy and removal of piece of liver for examination. Operator, Dr. Allen O. Whipple.

The exploratory celiotomy showed the entire liver to be deformed as the result of marked changes in its structure. Bands of a pinkish colored connective tissue divided the liver surface into various shaped oval and circular islands of normal appearing liver tissue. Because of the shrinking of these bands, the normal islands of liver tissue were pushed out, giving a disc-like or lenticular appearance to these islands. Near the gall-bladder one of these smaller islands was excised (Fig. 1) with a zone of the connective tissue about it. The gall-bladder was slightly thickened and showed many congested vessels in its subserosa. There were no gall-stones in the gall-bladder or ducts. The ducts felt normal as did the pancreas. No enlarged lymph-nodes

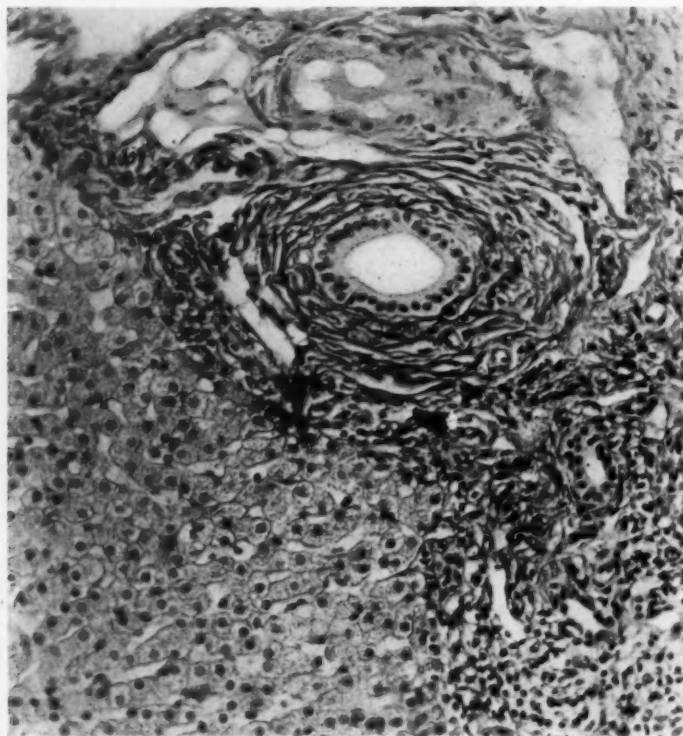


FIG. 2.—Photomicrograph showing line of transition between regenerated liver tissue and destroyed liver lobules.

connective tissue enclosing large and small bile ducts and vessels. The picture (Figs. 2 and 3) fits into a lesion which has at some previous time destroyed a large part of the liver substance. Diagnosis: Acute yellow atrophy (showing resolution).

The recovery from operation was uneventful surgically, but she soon began to complain of her old pain in her right side. At intervals she had attacks characterized by: 1. Anorexia, nausea and vomiting. 2. Pain and tenderness over right lobe of liver. 3. Very obstinate constipation. 4. Extremely foul breath with coated tongue. 5. Great mental depression and apathy.

These were not relieved by anything definite. The attacks cleared up after a certain time. Possibly local heat to the right upper quadrant gave the most constant relief. In addition she developed a rather obstinate cystitis, but cystoscopy failed to show any definite lesion.

were found at the cystic duct junction nor along the gastro-hepatic omentum, nor over the head of pancreas. On noting the above findings, no definite indication was found other than some hidden infective focus for a cholecystostomy, which was done at the suggestion of the medical consultants.

*Pathological Report.*—The nodule of liver tissue shows masses of relatively normal liver cells. The adjoining band or zone of tissue is made up of strands of connective

## ACUTE YELLOW ATROPHY OF LIVER

She was transferred to the Medical Service on March 17, 1924. There she improved for a time, but on being allowed up in chair, the same factor which had precipitated her other attacks, she came down with a very severe attack of the above five symptoms and her condition became very serious, and it was thought she would go into a cholemia. This, however, cleared up, and on April 10 she looked like an entirely different individual, felt well, cheerful, comfortable and happy.

The above syndrome is striking in a person having a very severe liver pathology. This syndrome is apparently brought on by overexertion, relieved by clyses and local heat to right upper quadrant.

The follow-up, nine months after operation, shows an unbelievable improvement. She has been at work for the last two months. She has not taken any sedatives of any sort for the last two months. Her only complaint is soreness over the liver area, but she has no indigestion, and her bowels are regular. Scar is linear, firm. Patient still has tenderness over the liver. Has gained in weight and is in remarkably good shape.

DR. CARL EGGERS showed two specimens from the liver of patients with acute yellow atrophy.

The first case was that of a woman, thirty-one years old, who died of acute yellow atrophy following a partial chloroform anæsthesia for acute suppurative appendicitis. She had received not more than 30 to 35 c.c. of chloroform. Her temperature had reached normal on the second day post-operative, but in the afternoon of the third day it began to rise and on the fourth day reached 104.6, when she died in coma. She had become slightly jaundiced on the day following operation, and this had gradually deepened. The diagnosis was made early on the clinical picture. Laboratory examination was of no value. She died in spite of energetic measures to inhibit the process and to stimulate her other excretory organs. The autopsy revealed normal post-operative conditions. The liver was about normal size, soft and had a smooth surface. The cut section looked somewhat like a nutmeg liver. Microscopically there was an acute degeneration of the parenchyma, most marked in the centre of the lobules. This process was beautifully demonstrated by staining with Sudan.

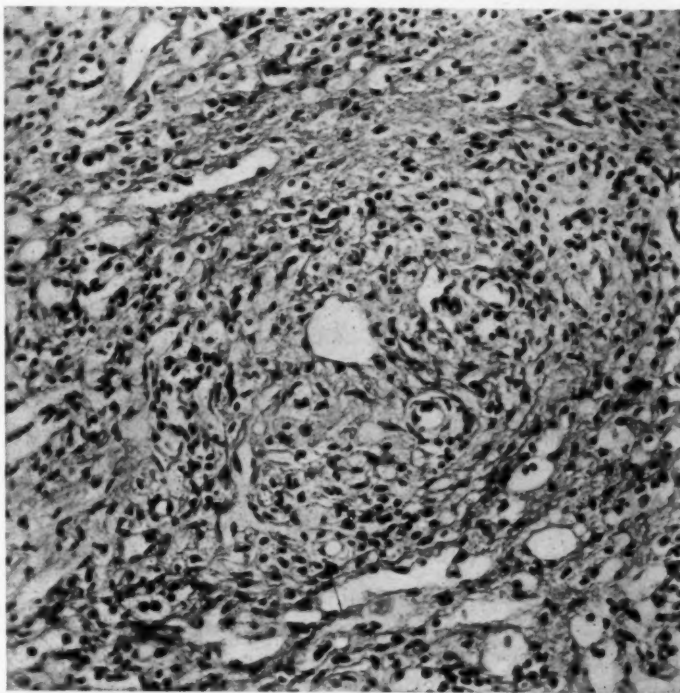


FIG. 3.—Section showing remains of liver tissue with ghosts of liver cells around central vein.



The second specimen came from a patient suffering from so-called primary acute yellow atrophy, in which no etiology could be found. She was a girl nineteen years of age, who began to complain of malaise, headache, and loss of appetite four weeks before admission. A few days later light icterus was noticed. She continued at work until she became so sick that she had to go to bed. The above symptoms became more marked and she began to vomit. She became slightly comatose. Eventually muscle twitchings developed and she became almost maniacal, to be followed later by deep coma. During all this time the jaundice deepened. On admission she was in coma, and was deeply jaundiced. She was very restless. There were many petechiæ scattered over the body. The liver was small. There was no ascites. The patient died twenty hours after admission with the diagnosis: Acute yellow atrophy.

At autopsy the liver weighed 800 gms. It was nodular, yellowish nodules projecting from a dark surface. On section similar findings were noted. Grossly it seemed that these yellowish areas were disease processes and that the dark areas represented normal liver tissue. Microscopical examination, on the other hand, showed that the yellow areas were those which resembled liver nodules in a state of more or less degeneration, while the dark areas were composed of connective tissue with round-cell infiltration and ducts lined with cuboidal epithelium. This process evidently represented a regenerative process of the liver. It is well known that the liver has great reparative powers.

DR. FREDERIC W. BANCROFT said that he had the pleasure of reporting with Doctor Pool two cases of yellow atrophy of the liver associated with nodular hyperplasia. Since that time he has seen two other cases. He has not been able to make a pre-operative diagnosis in any cases. These cases frequently show symptoms that are suggestive of common duct obstruction. Pain in the right upper quadrant radiating in the back associated with nausea. The jaundice occurs and becomes progressively more intense. The only symptom that seems to occur is faintness and weakness and a constant nausea. All of these cases went into coma and died. If one looked for lucin and tryosin in the urine, a pre-operative diagnosis might be made.

DR. EUGENE H. POOL said that he and Doctor Bancroft had observed and reported (S. G. O., 1925) two of these cases. In one the course was of long duration, and in that case there were large areas of new-formed liver tissue, the main mass of the liver having undergone degenerative changes. With the liver showing such marked ability to undergo regeneration or hyperplasia, it has always seemed peculiar that there is not evidence that some more of these cases get well. Doctor Whipple's is the first case the speaker knew of in which the diagnosis has been proved by gross visualization at operation, and by microscopic study, which has recovered, and from this point of view he thought it a peculiarly valuable contribution.

DOCTOR WHIPPLE, in closing the discussion, said that this is the only patient he had seen. He hoped he would have a ten-year follow-up on her, but if she has a recurrence of the condition from which she was suffering when she was in the hospital before, he doubted very much if she would survive it. Doctor Eggers' specimens reminded him of a case he explored where the diagnosis was acute yellow atrophy. The patient was comatose and was explored without anæsthesia. The exploration showed a remarkable



## AMÆBIC ABSCESS OF LIVER

looking liver, such as Doctor Eggers described. The patient died in twenty-four hours. There have been six cases of acute yellow atrophy at the Presbyterian Hospital within the last four or five years, two of them giving a history of so-called hæmolytic jaundice. In all of these cases leucin and tyrosin crystals were not found in the urine. Doctor MacCallum had a case of acute yellow atrophy which survived exploratory operation in which the liver was examined and diagnosis confirmed. The patient died of pneumonia nine months after operation.

## AMÆBIC ABSCESS OF LIVER

DR. ALLEN O. WHIPPLE presented a man, age forty-three years, who was admitted to the Presbyterian Hospital, March 22, 1923, on account of attacks of generalized abdominal pain, most marked in right lower quadrant, of seven months' duration. Past history essentially negative. In August, 1922, he began suffering with dull pains in right upper quadrant, gradually growing more severe. Two weeks after onset severe right upper quadrant colic with radiation to right shoulder, jaundice, chills and fever. He was taken to one of the municipal hospitals, where appendicectomy was done, and liver was noted to be enlarged, irregular and studded with masses. Discharged after two weeks.

Since that operation had been having almost daily attacks of sharp, knife-like pain, starting in right lower quadrant, extending over whole abdomen. Pain lasts a few hours, related to no special factor, and relieved by nothing. For about five days before admission pains were becoming very severe. Occasionally chills and chilly sensations. Jaundice noticed for past four months. No diarrhoea or gastro-intestinal symptoms. Loss of 30 pounds in seven months.

Physical examination showed loss of weight, slightly cachectic and jaundiced; enlarged, palpable, tender liver. Red blood-cells, 2,750,000; hæmoglobin, 55 per cent.; white blood-cells, 14,800; polymorphonuclears, 72 per cent.; Wassermann, March 7, 1923: Alcoholic +, cholesterol  $\pm$ . March 24, 1923, negative.

Liver function test showed absence of bile and retention of dye. X-ray showed high right diaphragm with suggestive enlargement of liver. Case remained diagnostic problem with tentative diagnosis of carcinoma of biliary tract.

March 31, 1923, amœbæ histolyticæ found in stools. The patient was put on a course of emetin, receiving bismuth iodide of emetin gr. iii at 10 P.M., emetin HCl gr. ss by hypo following A.M., also colon irrigation of three or four gallons of bisulphate of quinine (1-2000) o.n. This treatment was kept up for four days with marked drop in temperature to normal—previously being of septic type. Treatment stopped because of drop in blood-pressure from 105/70 to 88/62—resumed after four days and continued for one week. Temperature remained flat—no amœbæ found in stool. Liver function normal. Red blood-cells, 4,180,000; hæmoglobin, 75 per cent. Discharged April 23, 1923, symptom-free. Patient advised to return regularly to Out-patient Department for observation.

June 8, 1923.—Interval after leaving hospital two months. Patient has had no recurrence of former symptoms. Has gained above five pounds in weight. Looks well. Physical examination shows liver markedly decreased in size. Is not tender. Lower edge is just palpable. The decrease in size of this is remarkable.

December 19, 1924.—Twenty-one months after discharge. Patient has no complaints whatsoever. He is in excellent physical condition. Working as night watchman regularly. He desires to change to day work. He has no digestive disturbances. Bowels move regularly. He has no pain or discomfort in the region of the liver. Physical examination shows well-nourished healthy looking man with a liver dulness in normal limits. No tenderness. He is apparently relieved of former trouble. He has noticed a thickness, and some discomfort in the vein of left arm where a definite cord can be palpated along the inner side of arm and forearm. It is evidently the result of organized thrombophlebitis.

#### CIRRHOSIS OF LIVER WITH OMENTOPEXY AND SPLENECTOMY

DR. ALLEN O. WHIPPLE presented a man, aged thirty-six, who came into the Presbyterian Hospital, August 24, 1920, complaining of vomiting blood and weakness; during last two months had had several hemorrhages. Past history irrelevant except for a winter when he was "threatened with tuberculosis and sent to country." Physical examination showed athletic young man with anæmia 50 per cent., 3,500,000 red blood-cells, without any abnormality of smear, and a large spleen. Otherwise physical was negative. Wassermann was negative. With these a diagnosis of Banti's disease was made.

After admission the man had several hemorrhages and was transfused. Signs of ascites developed and in view of the hopelessness of his condition, splenectomy was done and a large cirrhotic spleen removed. He developed a post-operative pneumonitis of right lower lobe. Temperature continued irregular after the lungs cleared up and the patient became subjectively better.

One month after operation he developed a thrombo-phlebitis of the right arm which extended to the right supraclavicular region. Also a small amount of clear fluid was withdrawn from the right thorax by aspiration. The phlebitis disappeared and reappeared again in the next few weeks, during which time he also developed jaundice, of short duration. Blood improved gradually, hæmoglobin 90 per cent., red blood-cells 4,500,000, white blood-cells 15,000, polymorphonuclears 52 per cent., and at time of departure from hospital he was subjectively feeling well, although weak. He had a few râles at right base, mild cough and sputum, and an irregular temperature, suggesting, except for the improved weight and physique, a pulmonary tuberculosis, which with his past history should be borne in mind.

*Final Diagnosis.*—Banti's disease, splenic anæmia; splenectomy. Thrombosis of right brachial vein.

Follow-up, January 9, 1925, fifty-two months after operation. The man has been in excellent health since last visit. He has had no recurrence of swelling of the abdomen, no shortness of breath, no œdema of feet or ankles, no swelling of right arm, his digestion is excellent, bowels regular without catharsis. Two weeks ago he had a digestive upset which he has attributed to crabmeat, otherwise digestion is excellent. Working regularly. Physical examination shows patient looking remarkably well, except for possibly some anæmia. His abdomen shows firm linear scar, except at upper angle where there is possibly some bulging as result of the omentopexy. The abdomen is full, but shows no evidence of fluid wave. Liver is somewhat decreased. Liver edge cannot be made out. There is no œdema of the extremities. No evidence of phlebitis of the arm. Sent for blood count.

*Comp. Blood Count.*—Hgb., 94 per cent.; W.B.C., 6800; R.B.C., 4,569,000; polys., 63 per cent.; S.L., 28; L.L., 4; eosin., 2; L.M., 3.

## COMPOUND DEPRESSED FRACTURE OF CRANIAL VAULT

DR. DEWITT STETTEN said that since showing a case similar to Doctor Whipple's before the Society in November, he had operated on two others but, unfortunately, without success. He felt, however, that this operation was indicated in certain instances and would give a fair percentage of successful results, but that one ought not to be too enthusiastic. The two other cases on which he had operated were as follows:

One was a man of sixty-three years, who had been suffering from an extreme recurrent ascites of fourteen months' duration, due to syphilitic cirrhosis. The condition had resisted all therapy. The patient was in very poor condition and the operation was attempted as a last resort. He survived a rapid, rather simple, splenectomy and a Mayo modification of a Talma-Morison omentopexy by only a few hours.

The other case offered a little more hope. The patient was a woman of forty-five years, who developed an intractable ascites after an exploratory operation for a diffuse gummatous condition of the liver. In spite of anti-syphilitic treatment, the Wassermann remained 4+, and repeated tapplings to relieve the ascites were resorted to for about six months. Finally a splenectomy and a Mayo modification of a Talma-Morison omentopexy were done, from which the patient made a good recovery. After the operation the ascites recurred and the patient was tapped five times, but her general condition showed marked improvement. Suddenly, six weeks after operation, she developed an acute right-sided bronchopneumonia and died within forty-eight hours.

The patient shown in November is still apparently in perfect health.

## COMPOUND DEPRESSED FRACTURE OF CRANIAL VAULT

DR. WALTER A. SHERWOOD presented a boy, six years of age, who was brought to the Brooklyn Hospital, June 24, 1924, shortly after being struck by an automobile. When admitted he was entirely conscious and showed none of the usual signs of intracranial injury. Examination of the head revealed a ragged punched-out area in the scalp about one and a half inches in diameter in the right upper frontal region, near the junction of the frontal and parietal bones. Further examination of this wound revealed a marked depression in the skull from which there was rather profuse bleeding.

The patient was taken promptly to the operating room and after a thorough disinfection of the scalp the wound was debrided, enlarged and the following conditions were revealed: Three pieces of bone with sharp edges, consisting of both tables of the skull, had been driven through the dura mater and were embedded deeply in the substance of the brain. The largest of these fragments was ovoid in shape and one and a half inches in length by seven-eighths wide. The other fragments were sharp, narrow and from three-quarters to seven-eighths of an inch long. Only small portions of these fragments could be seen and felt, the larger portion being deeply buried in the brain. The opening in the skull was slightly enlarged and the fragments were removed with as little injury as possible to the brain substance which was lacerated and portions of which protruded through the torn dura into the external wound. Some detached brain tissue was removed and the torn dura mater was incompletely closed with a catgut suture. All bleeding was satisfactorily controlled and a small rubber tissue drain was introduced

through the tear on the dura and brought out at the posterior angle of the scalp wound. This was now carefully sutured over the defect in the skull.

The post-operative course was uneventful. There were no signs of cerebral irritation or disturbed motor or sensory function. The wound healed by primary union, but at the time of the patient's discharge from the hospital, two weeks later, there was a distinct bulge and pulsation at the site of the bony defect in the skull. He was fitted with a firm pad of piano felt, which was tightly strapped over the opening in the skull. This was worn for several months.

This patient has been observed from time to time and there has been a

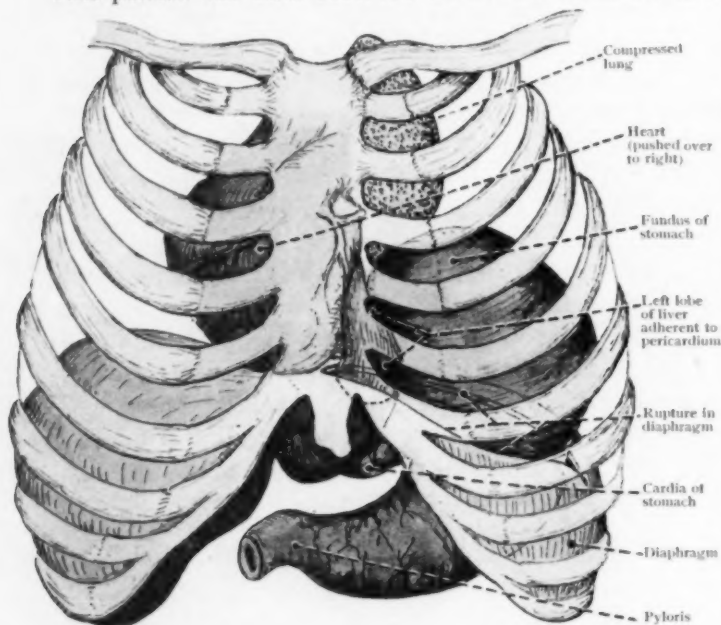


FIG. 4.—Diagrammatic representation of the liver and stomach herniated into the left pleural cavity.

complete disappearance of pulsation and cerebral bulge.

The case is presented to illustrate: *First*.—The absence of functional disturbance in the presence of rather extensive brain injury. *Second*.—The process of bone regeneration and tissue repair in a defect of the skull which presented the early signs of a cerebral hernia.

#### TRAUMATIC DIAPHRAGMATIC HERNIA

DR. WALTER A. SHERWOOD presented a boy, eight years of age, who was admitted to the Brooklyn Hospital, February 1, 1924. Shortly before admission he had been struck by a motor truck. The exact nature of the accident could not be ascertained. He was badly shocked, his respirations were labored, and his skin and mucous membranes were deeply cyanosed.

Examination of the chest revealed fractures of the seventh, eighth and ninth ribs in the axillary line of the left side. There was tympany over the entire left chest with amphoric breath sounds and both coarse and crackling râles. There was also tenderness and rigidity over the left upper abdominal quadrant.

The condition of the patient was critical and remained so for several days. His heart became displaced markedly to the right side and the physical signs were those of a hydro- or hæmato-pneumothorax. On the fourth day after admission an X-ray of the chest revealed fractures of the seventh, eighth and ninth ribs and the presence of a large amount of fluid in the chest cavity. There was no normal lung shadow seen. On the twelfth day eleven ounces of dark bloody fluid were aspirated from the chest. The patient's condition



## TRAUMATIC DIAPHRAGMATIC HERNIA

had improved slightly, although the heart was still very much displaced to the right and there was no respiratory excursion on the left side. The physical signs were persistently those of both fluid and air in the chest.

A further X-ray study on the fourteenth day revealed the presence of encapsulated air or gas above the diaphragm and with a bismuth meal the stomach was found well up beyond the diaphragm in the pleural cavity. It was now evident that the accident had resulted in a crushing injury of the thorax with rupture of the diaphragm taking place simultaneously with the injury to the bony wall of the thorax.

The physical signs were now readily accounted for and the case was further studied from the standpoint of appropriate surgical treatment.

General improvement slowly continued and on March 29 the patient was submitted to operation for the repair of the hernia. The abdominal route was selected in preference to the transpleural attack. Anæsthesia, nitrous oxide, four minutes, ether 6 ounces. Incision beginning just to the left of ensiform and carried downward

and outward through the left rectus muscle, to below the umbilicus. There was an opening in the left leaf of the diaphragm, triangular in shape, with its apex directed outwards and its base corresponding to the centre of the diaphragm; this opening was large enough to admit the entire hand into the thoracic cavity; through it almost all the stomach, a part of the left lobe of the liver, and considerable omentum had been herniated into the cavity of the thorax. (Fig. 4.) The left lung was completely collapsed in the upper part of the cavity. There were numerous omental adhesions to the edge of the opening in the diaphragm.

*Procedure.*—Adhesions were separated, ligated and cut. The stomach and left lobe of the liver were then brought down within the abdominal cavity by means of traction and manipulation and while held in this position the wound in the diaphragm was closed with interrupted sutures of chronic catgut. It was completely closed in front and the cardiac end of the stomach was used to reinforce the suture line by means of a few interrupted sutures

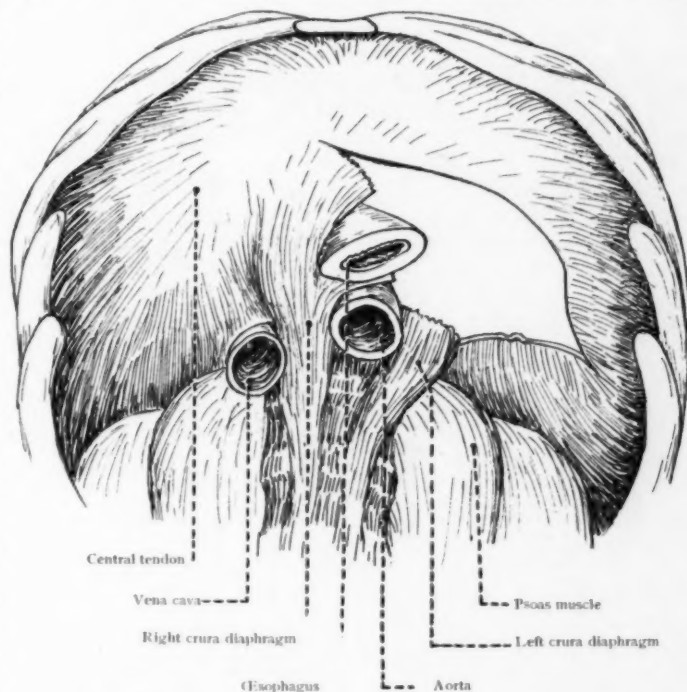


FIG. 5.—View from below showing the rupture in the diaphragm.



between it and the diaphragm. Posteriorly it was impossible to completely close the hernial orifice, no suitable structure being found to suture. The replaced organs seemed to remain in their normal positions and the patient's condition did not permit of further operative risk. A good operative recovery followed with primary wound healing.

Subsequent X-ray studies showed the stomach to be well below the diaphragm except for a small pouch of the cardiac end, which protruded

through that portion of the defect which could not be closed.

Four weeks after operation an increasing temperature developed and fluid was found in the pleural cavity. Several ounces of pus were aspirated, the patient improved and further drainage was not indicated. The patient made steady progress, gained in weight, and there was a gradual return of the heart toward its normal position. Flatness and other signs of a thickened pleura persisted in the axillary line over the lower half of the chest.

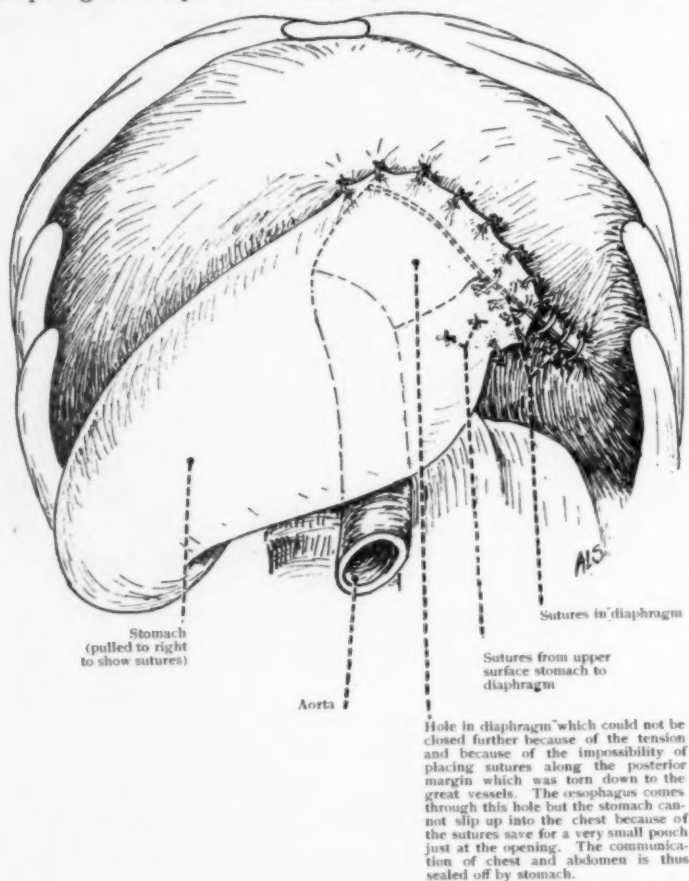


FIG. 6.—Diagram of the operative procedure.

#### CARCINOMA OF THE CÆCUM WITH INTUSSUSCEPTION OF THE INVOLVED BOWEL

DR. WALTER A. SHERWOOD presented a woman, thirty-eight years of age, who was admitted to the hospital, March 5, 1924. Her chief complaint was pain in the right side of the abdomen which had persisted for four months. It began with sharp pain in the right lower quadrant followed by a desire to defecate. She passed material from the bowel resembling red paint and immediately following this fainted. She subsequently had similar attacks and almost daily she had several attacks of acute abdominal pain. There has been a constant feeling of drag in the right lower quadrant. She occasionally passes bloody mucus from the bowel and has lost 55 pounds in weight.

Physical examination negative except for the abdominal condition. In

## CARCINOMA OF THE CÆCUM

the right iliac fossa is an easily palpated mass the size of a lemon; it is freely movable and tender to pressure. Proctoscopic examination showed a normal rectum and lower colon except for the presence of blood and mucus. Test-meal negative. Examination of stools showed the presence of blood. Hæmoglobin, 65 per cent.; red blood-cells, 3,900,000.

An X-ray study was made with the following findings: Opaque enema fills the entire colon tract. No gross filling defect seen. There is an area in the cæcum which is less dense than the surrounding colon, but the outer contour of the colon seems negative. Transverse colon is apparently negative.

Examination made twenty hours later shows a little residue in the region of the hepatic flexure and some in lower descending colon and sigmoid. The left kidney seems a little large.

Findings: Fairly negative. No gall-stones seen, but gall-bladder shadow apparently seen. There are well-defined whirls of barium seen in the region of the hepatic flexure. This apparently is residue from enema given two days previous. With patient prone stomach comes to the level of the first lumbar vertebra. With patient erect, it comes about six inches lower. It is rather large and is not seen in active peristalsis. No constant filling defect seen. Stomach extends far to the right and shows pressure defect. No entirely satisfactory cap is seen. Meal passes slowly into the small intestine.

*Five and three-quarter Hour.*—Slight gastric residue. Meal scattered through the small intestine and it is entering the cæcum. It is in this area that the barium is seen as a whirl with the central area less dense. The ileum right at the ileo-cæcal valve is constricted and the ileum back of it seems dilated.

*Twenty-four Hour.*—Colon tract seen from cæcum to rectum. Same defective area seen up to the hepatic flexure—in fact, this region looks identical as at twenty-hour examination after enema. Transverse colon spastic. Descending colon and sigmoid and rectum about normal.

Defective area in right colon seemed to be exactly over tender mass felt on palpation. This defect probably corresponds to area of less density seen in cæcum in enema examination.

*Diagnosis.*—Gall-bladder disease; carcinoma of cæcum with obstruction close to hepatic flexure.

March 13, 1924, the patient was submitted to operation. A right rectus incision was made from just below the free border of the ribs well down below the umbilicus. A movable tumor, about the size of a large lemon, was found in the transverse colon. It seemed like a tumor with a long pedicle. The transverse colon was opened longitudinally for inspecting this tumor, which was found to be an intussuscepted adeno-carcinoma of the base of the cæcum. This had been carried up through the ascending colon into the transverse colon and seemed impossible of reduction.

*Procedure.*—1. Tumor and attached cæcum were drawn still further up on the inside of the bowel. A Payr clamp was secured around the bowel about two inches below the growth, which was then removed with cautery, together with healthy bowel. Edges were sutured with a double row of continuous chromic sutures. The longitudinal wound in the bowel was closed with a double row of Lembert sutures of chromic catgut and the external wound in the cæcum was closed in a similar way. 2. A loop of the terminal ileum was brought up to the transverse colon and a side-to-side ileo-colostomy was done in the usual manner. A layer of iodoform gauze was inserted down to site of resected bowel and brought out at lower end of wound. Wound closed by layer sutures as usual.

The patient made an excellent recovery and aside from distention and

the usual discomfort of three days' duration, she improved rapidly, and a good fecal current had been established at the end of the sixth day. From this time on she had daily normal bowel movements.

There was a discharge of colon bacillus pus from the drainage tract which persisted for about a week and then promptly cleared up. The remainder of the wound healed by primary union.

She was discharged from the hospital at the end of three weeks, improving rapidly in general health and free from all symptoms.

*Microscopic Examination.*—The tumor is lobulated; composed of narrow infiltrating and anastomosing strands of epithelial cells. The mucosa is ulcerated over the crests of the hypertrophic and infiltrated rugæ; the tumor reaches the muscularis. The subserous coat shows œdema and recent proliferation of fibrous tissue and is infiltrated with round cells. No gland formation is observed in the tumor.

This woman has been observed at regular intervals. She has regained her entire weight loss, feels perfectly well, and has no disturbance of her digestive tract.

#### CARCINOMA OF THE RECTUM—(FOUR YEARS RESULT)

DR. WALTER A. SHERWOOD presented a man, fifty years of age, who was operated on four years ago for an adeno-carcinoma of the rectum. For six months he had complained of an aching pain which he thought was due to hemorrhoids, was habitually constipated and occasionally passed some blood and mucus from the bowel. His general condition was good. There was an annular, ulcerating growth about two inches above the sphincter muscle. The growth encroached on the lumen of the bowel and partially occluded it. There was apparently no involvement of the outlying structures. His Wassermann was negative and a preliminary biopsy verified the diagnosis.

He was operated on in two stages, the first stage being the establishment of a permanent artificial anus by means of an inguinal colostomy. Ten days later a complete excision of the rectum was done, together with the sphincter muscle, peri-rectal fat and lymphatics. The approach was facilitated by the removal of the coccyx, and the reflection of an osteoplastic flap of the sacrum.

The patient made a prompt recovery and he was discharged from the hospital seventeen days after the second operation with a healed wound.

He had no sign of local recurrence or remote metastases, remained in excellent health and follows his usual occupation in a banking institution with entire satisfaction. Doctor Sherwood said that growths of this type are best managed and with a greater prospect of complete eradication of the disease by the establishment of a permanent artificial anus than is possible when one leaves the sphincter muscle and attempts to reestablish the continuity of the rectal tube. This patient wears a rubber colostomy bag which he changes once or twice each day and has less annoyance and inconvenience than is often noticed in patients in whom the resected rectum or lower sigmoid has been brought down and sutured to the anal orifice. In this type of growth the removal may be made more complete and the benefits of operation more permanent than is possible in any other way.

#### METASTATIC ABSCESS OF LIVER

DR. HERMANN FISCHER presented a woman, aged thirty-six years, who was admitted to Lenox Hill Hospital, May 7, 1924.

Two weeks previous to her admission she was curetted at her home and five days later became very ill with a temperature of 104–105°. Since that time she has run a septic temperature with chills. Blood count: Red blood-

## METASTATIC ABSCESS OF LIVER

cells, 19,000; polymorphonuclears, 96 per cent.; haemoglobin, 45 per cent. Blood culture: Negative. Wassermann: Negative. Urine contains albumin, casts and pus. Received several injections of mercurochrome intravenously (10 c.c. of 2 per cent. solution).

Some of these injections were followed by a chill and a rise of temperature to 105°, but the next day after the injection the temperature would be normal and the patient would feel comparatively well. She developed a broncho-pneumonia at both bases with signs of pleuritic effusion, was tapped twice and each time 60 c.c. of serosanguineous fluid were removed, which proved to be sterile.

During the following week a pelvic abscess formed, which broke into the vagina. The opening in the Douglas sac was enlarged and tube inserted for drainage. After this the patient improved rapidly and insisted upon going home, although the physical signs on both bases of the lung persisted, and although she was still discharging considerable pus from the vagina.

A few days after she went home she noticed that fecal matter passed per vaginam with every bowel movement. She had fever at times which was associated with headaches. She was re-admitted. Looks chronically ill and anæmic. Over the chest there are a few moist râles over both bases posteriorly. There are no masses in the abdomen, but the lower portion is tender on palpation. The fundus of the uterus is palpable midway between the umbilicus and symphysis; there is a thick, yellowish discharge of pus from vagina; there is present an old laceration of the cervix. Cervix admits one finger. There is a discharging sinus in the posterior fornix leading into Douglas' pouch. Both fornices are tender.

Blood count: Red blood-cells, 2,800,000; white blood-cells, 16,300; polymorphonuclears, 84 per cent.; haemoglobin, 70 per cent.

Urine contains: Albumin, casts and pus cells. Culture from urine: Bact. coli.

Methylene blue injected into the vaginal end of the vaginal fistula, stained a cotton ball inserted high into the rectum, proving the existence of a recto-vaginal fistula. She continued to run a septic temperature. Several days later she developed more physical signs in the right lower chest. Probably a lightening up of the old pneumonic process.

X-ray of chest shows that there still remains consolidation in the lower right base of the lung. There is no evidence of fluid. Although unimproved, the patient insisted upon going home after a second stay in the hospital of three weeks, July 8, 1924.

Patient is re-admitted on August 28, 1924.

Although her general condition has improved and her recto-vaginal fistula has healed, the patient coughs, has pain in her chest on the right side and no appetite.

Examination of chest shows an area of flatness, absent breath sounds and absent fremitus over lower half of right chest with dullness and râles above this area.

Liver edge is palpable five fingers' breadth below costal margin.

Vaginal examination shows a chronic posterior parametritis. Vaginal fistula healed.

Blood count: Red blood-cells, 5,250,000; white blood-cells, 15,250; polymorphonuclears, 79 per cent.

During the first week patient ran a slight temperature with a fast pulse. Later temperature went up to 105, pulse was rapid. Patient decidedly worse. The signs in the right lower chest persisted. The breath became foul and



at times her cough was productive of sputum. The pain in the right chest persisted and she also had pain at times in the upper right hypochondrium.

The white blood-cells increased from 15,250 to 25,000, with 95 per cent. polymorphonuclears. Blood culture was sterile.

Radiographic examination of the chest of the patient on September 2, 1924, shows the lungs to be clear.

The diaphragm on the right side appears to be raised still higher than at a previous examination. It appears regular in outline, but is almost one inch higher. There is no consolidation or fluid on right side of chest.

Radiographic reëxamination on September 8 shows the right border of the heart to be occluded by the raised right diaphragm. The diaphragm appears to be on a still higher level than on September 2. The apex being at the level of the sixth rib in posterior axillary line. The series of plates rather indicates a lesion under the diaphragm, probably abscess.

*Operation* (September 8, 1924).—Local anæsthesia: Adrenalin and one-half per cent. novocain. Patient was put on her left side in a half-sitting posture with the right arm raised over her head. After several unsuccessful attempts the aspirating needle struck thick pus in the anterior axillary line in the seventh intercostal space. The aspiration needle was left *in situ* and a six-inch incision made along the eighth intercostal space. The ninth and tenth ribs were resected to the extent of  $4\frac{1}{2}$  inches. The intercostal tissue were also removed without opening the pleura. A 5-cm. incision was now made into the pleura in the costo-phrenic angle, the pleural space above the incision meanwhile being compressed and protected by gauze compresses, so that no air or fluid could enter the chest cavity. The incised pleura was then sutured air-tight to the diaphragm with continuous plain catgut sutures exposing an elliptical area of the dome of the diaphragm. The diaphragm which looked normal was now incised. The subphrenic space was free of fluid and pus. Careful packing of subphrenic space around area of liver to be attacked. The aspirating needle which was still in place showed the way into a large abscess, which was situated in the upper posterior aspect of the large lobe of the liver. A dressing forceps was pushed along the needle, using it as a guide into the abscess cavity. A pint of thick, yellow pus was evacuated. The track in the liver tissue was widened by the finger and a large calibre rubber drainage tube inserted. The abscess proved to be a very large one with a very thick and tough abscess membrane, which offered considerable resistance to the dressing forceps. It was situated about three inches below the surface of the liver.

The general condition of the patient was fair after the operation.

The temperature remained between  $102-104^{\circ}$  the first two days. Seven days post-operative the gauze packing in the subphrenic space was removed and the drainage tube shortened; discharge much less, temperature normal. The wound healed after several weeks and the patient is now well, having gained 50 pounds in weight.

#### MANAGEMENT OF INTRACRANIAL INJURIES WITH OR WITHOUT OPERATION

DR. JOHN F. CONNORS read a paper with the above title, for which see page 901.

DR. CHARLES S. B. CASSASA (by invitation) referred to two of the points in the paper: 1. concussion of the brain; and, 2, the question of cerebral œdema. The former, although a very common injury, rarely is fatal, and therefore the material for pathological study is very limited. During the last



## MANAGEMENT OF INTRACRANIAL INJURIES

ten years the speaker was able to collect only seven cases of concussion of the brain out of several thousand autopsies upon individuals dying as the result of trauma to the head. Upon gross examination of the brain five showed very many scattered minute hemorrhages; there were but two cases where gross examination showed a perfectly normal brain. These two persons, it was ascertained from reliable eye witnesses, died instantly, and on the spot where they received their injury. In the group of five cases, there was a normal conformation of convolutions and sulci. Flattening of the convolutions was not present. The aggregate of these punctate hemorrhages does not make a large blood clot and hence there was no flattening. The microscopic examinations of the areas of hemorrhages showed some of the hemorrhages limited to the perivascular lymph spaces; others extended into the immediate adjoining brain substance. Examination of a microscopic section of a normal brain, fixed by embalming before its removal from the body, shows a network of fine fibrils connecting the external wall of the blood-vessel with the surrounding brain tissue across the perivascular lymph space. The speaker believed the mechanism of concussion of the brain to be as follows: With the blow or fall upon the head there is a change of shape of the skull. This change of shape under an area of violence is in the direction of flattening with diminution of space for the cerebrospinal fluid in that area. This fluid on the surface of the brain must find its way out of that area through the various sulci of the brain, and the fluid that cannot find its way through these channels must find a way into the perivascular lymph spaces, in the reverse direction of the normal flow of the cerebrospinal fluid in these channels. Sudden overflowing of the perivascular lymph spaces with cerebrospinal fluid produces a laceration of a vessel by the tearing of its wall in the neighborhood of such a fibrillar attachment. Otherwise, without such attachment, the laceration of a vessel surrounded by fluid could not be produced by any pressure exerted through that fluid which would only tend to compress the vessel but not lacerate it.

As to the question of cerebral oedema, Doctor Cassasa showed a photograph of a brain having multiple punctate hemorrhages and normal conformation of convolutions and sulci from a person who had been operated upon with a post-operative diagnosis by the surgeon of cerebral oedema. When the arachnoid was incised through a sub-temporal trephine opening, the cerebrospinal fluid gushed out under great pressure. Personally, the speaker had never seen flattening of the convolutions and narrowing of the sulci in an individual dying as a result of a head injury where there was not a compressing substance, as a blood clot, bone, or other foreign material, or an infection, which caused an encephalitis. He doubted the existence of cerebral oedema following trauma to the head as a pathological surgical entity.

DR. GEORGE E. BREWER said that previous to 1912, while on active duty at Roosevelt Hospital, he had observed a large number of cases of cerebral injury which were admitted to the wards of that institution. During the latter period, he had passed through several stages of opinion in regard to

the treatment of these injuries, as had Doctor Connors, except that they were reversed. In the beginning, his policy had been to treat these cases conservatively, only operating where the indications were clear, and where the evidence of injury was local rather than general. As the results were unsatisfactory, he next passed through a period where he attempted to relieve the symptoms by various types of operation. As in many of these cases the injury was largely in the region of the base of the brain, and difficult to explore, the results in general were equally unsatisfactory. As in a number of instances, the lesion seemed to be unfavorably influenced by operation, he again adopted the plan of more conservative treatment; and where operation was indicated for the relief of a progressively rising blood-pressure and signs of cerebral compression, he contented himself by doing merely a decompression operation as advised by Cushing. Without recalling the exact statistics of this series, he could only give his impression of the results, which while somewhat better in a few instances, was on the whole disappointing. During the period of these observations, he was constantly assisted by the advice of the late Dr. Pearce Bailey, the consulting neurologist to the institution, whose views always tended towards conservative rather than radical treatment, believing as he did, that where the injury was susceptible of spontaneous recovery, operation only did harm, while in the cases of grave laceration and hemorrhage, operation in the majority of instances was of little or no value. He considered that the work that Doctor Connors was doing, and the opportunities he had of observing a large number of cases of cerebral injury, would doubtless furnish, later, reliable statistics upon which could be based definite indications for treatment; and that he hoped Doctor Connors would continue these observations and would from time to time report his results to this Society.

DR. SETH M. MILLIKEN said that the cases in which operation should be done are those that show definite indications, the findings are so unsatisfactory in many of the cases. He had a case of a woman who fell, striking the back of her head so heavily that a comb she was wearing was driven into the scalp. She was unconscious for a few moments only. Her symptoms were severe nausea and dizziness, that kept up for over two weeks. She vomited every day for fifteen days after the injury and the dizziness persisted for sixteen days and then passed off. She showed no symptoms of cortical cerebral injury; no abnormality in the fundus. The only suspicious sign of fracture was slight ecchymosis under the left mastoid, probably due to the scalp injury.

DR. HAROLD NEUHOF said that Doctor Connors had shown clearly that there is no indication for such an operative procedure as decompression for intracranial injury in the great majority of instances. It was not clear to the speaker just what the term "concussion" meant. As he understood it, Doctor Connors meant widespread, small, cerebral hemorrhages. Was it to be understood that a patient with a blow on the head and suffering transient unconsciousness had multiple hemorrhages scattered throughout the brain? As it is not understood what has happened when "concussion" occurs, and

## MANAGEMENT OF INTRACRANIAL INJURIES

because patients having suffered transient unconsciousness are apt to be disregarded clinically, would it not be wise to discard this term? It is impossible to evaluate the extent of an injury because only transient unconsciousness has existed. He had repeatedly seen patients suffering from transient unconsciousness present bloody fluid in routine spinal puncture examinations. Doctor Connors attempted the differentiation of types of cranial injuries by measuring the degree of bloody fluid in the spinal canal. In the speaker's experience, it was a striking thing to find that many patients with evidently light grades of intracranial damage had bloody spinal fluid. Therefore, bloody fluid is evidence only of the existence of traumatic bleeding within the pia-arachnoid, but is not a measure of the extent of the intracranial injury. Negative spinal taps may be present in grave injuries, but bloody spinal fluid indicates that close clinical observation of the course of the case is indicated.

Concerning the operative exposure, Doctor Neuhof did not agree that the operation should always be carried out in the region of a fracture, but rather in the region to which the brain damage or compression had been localized. There may be no fracture with severe intracranial damage, or the damage may be some distance from the site of fracture. Especially in middle meningeal hemorrhage a low temporal exposure should be made for the vessel is ordinarily injured in this region and can be best secured by such an exposure. Otherwise, by merely pursuing the line of fracture that may be present, an unnecessarily wide removal of bone may be required for the adequate exposure of the lesion.

DR. JOHN J. MOORHEAD stated that a number of these cases occurred during the period when he was connected with Harlem Hospital and he was very glad to see that a compilation had been made of such a large number.

His own opinion was that operation for fractured skull was really only required under three circumstances, all of them giving some manifestation of focalized as distinguished from generalized pressure. These three things were: Simple or compound depressed fractures, meningeal hemorrhage, and well-localized foreign bodies. Indiscriminate operation for fracture of the skull was distinctly bad surgery and children in particular rarely required operative interference. He had understood Doctor Connors to say that the posterior branch of the middle meningeal artery was oftener involved than the anterior branch; and if that proved to be the case, then numbers of people would have to revise their former opinion as to this common site of external hemorrhage.

# TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting Held February 2, 1925*

The President, DR. EDWARD B. HODGE, in the Chair

## CRANIAL ENDOTHELIOMA

DR. F. C. GRANT presented a man, fifty-eight years of age, who, when admitted for treatment, presented a large protrusion of the parietal region on the right side of his cranium. (Fig. 1.) The mass was hard not tender; the veins over it were engorged. He stated that for ten years or more the right

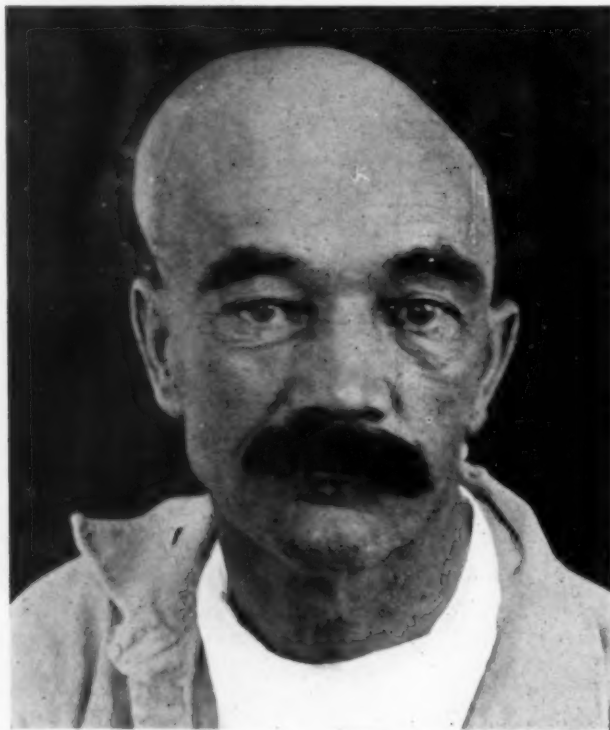


FIG. 1.—Showing cranial exostosis before operation.

side of his head had been gradually enlarging; one year ago he began to have headaches and vomiting; ten months ago convulsive attacks began to occur at intervals of about once a month; these attacks would begin with twitching of the arm followed by loss of consciousness. Nine months ago he began to have weakness of the left side of his body, which gradually progressed until the left upper limb became completely helpless and the left leg notably weaker than the right. He is able to walk and drags the left leg only slightly. With the diagnosis of tumor of the right molar and parietal areas, with hyperos-

tosis of the cranium, he was subjected to a craniectomy in the right fronto-temporal region under local anæsthesia plus three ounces of ether.

A right-sided, fronto-temporo-parietal flap was thrown back to include the greater part of the bony growth. The flap extended up close to the midline and the base was placed in the temporal region. The bone was enormously thick, at least one inch in places, and a good deal of trouble was experienced in cutting the flap. In raising the flap, the dura was tightly

## CRANIAL ENDOTHELIOMA

adherent, all over its inner side, and was badly torn in elevating the bone. The inner side of the bone was porous and eaten away. There was a rough, strawberry-appearing growth, between the dura and the cortex, and adherent to the cortex. It was difficult to free this from the cortex as there were many connections between the neoplasm and cortex veins. It was found possible, however, to make a line of definition and to shell out by careful finger dissection a tumor from the depth of the motor cortex, solid, encapsulated and well-defined, about 5 or 6 cm. in diameter. (Fig. 3.) There was a little sharp bleeding on removing the tumor which was readily checked by a muscle graft.

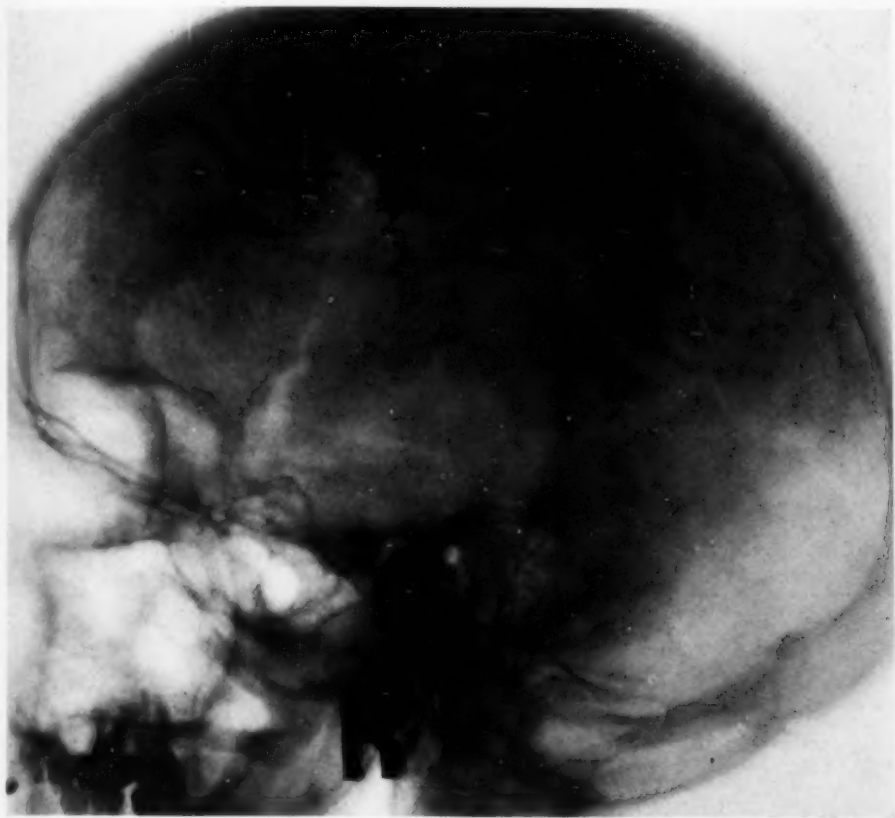


FIG. 2.—Röntgenogram showing bone involvement at cranial vertex, before operation.

The dura had been so lacerated and torn that a large fascial transplant was obtained from the fascia lata of the left thigh and the defect in the dura repaired. The temporal muscle was apparently entirely infiltrated by the tumor mass and for that reason was removed with the bone flap.

After hæmostasis was made as perfectly as possible, the skin was sewed back in place. Patient received 500 c.c. of blood from a suitable donor. Condition on leaving operating table good. He was conscious and answering questions.

*Post-operative Notes.*—Within a week of removal of tumor, the patient had regained completely the use of his arm and leg. After radium treatment, he was discharged. On discharge, he walked normally. Except for slight



clumsiness in the finer movements of his hand, his left upper extremity had regained its function completely.

*Pathological Report.*—Endothelioma. The bone also shows marked infiltration by tumor cells.

Figure 4 shows the operative scar and defect left by removal of the bone flap.



FIG. 3.—Bone flap and tumor mass removed at operation.

DR. ASTLEY P. C. ASHHURST said that at the meeting of the Academy held February 2, 1920 (*ANNALS OF SURGERY*, 1920, vol. lxxii, p. 402), he had reported a case of Jacksonian epilepsy caused by a dural endothelioma, and he took the present occasion to record that examination of the thickened overlying cranium in this case by Prof. Allen J. Smith showed no invasion by the cells of the dural tumor. At the time of the original report the bone

## CARCINOMA OF LATERAL ABERRANT THYROID TUMOR

had not been examined; but the subsequent report by other surgeons of a number of similar tumors in which the bone had been invaded by the tumor, made this report appropriate.

DOCTOR GRANT remarked that in the case presented he had felt certain from the X-ray picture, from the thickness of the bone and the adhesions between the bone and the dura, that the bone had been involved by tumor cells. In most of the cases of meningioma reported by Cushing, the bone was involved. This also occurred in the case recently reported by Phemister. With almost certain involvement of the bone, it seemed best to remove the flap in its entirety and leave the patient with a large cranial defect, rather than to replace the bone and chance a recurrence of the tumor.

### CARCINOMA OF LATERAL ABERRANT THYROID TUMOR

DR. ARTHUR E. BILLINGS reported the history of a man, aged fifty-six years, who had always enjoyed good health, until in February, 1923, he first noticed a small swelling about the size of a marble on the left side of his neck. A year later, about January, 1924, he noticed that it was increasing in size. Since then it has enlarged more rapidly. It has never been painful and he says that it has not interfered with his health. He was first seen by the reporter in July, 1924. In his neck was then present a tumor, as large as a small lemon, of firm consistency and not attached to the muscle. It was on the left side beneath the sterno-cleido-mastoid muscle and just below the angle of the jaw. No evidence of glandular enlargement elsewhere. Thyroid is about normal in size and there is no evidence of pathological change in it or derangement of its function.

After the first examination a tentative pre-operative diagnosis of endothelioma or lymphosarcoma was made. The patient was referred to Doctor Manges for X-ray treatment and study preliminary to operation. X-ray treatment was continued over a period of three months with very marked

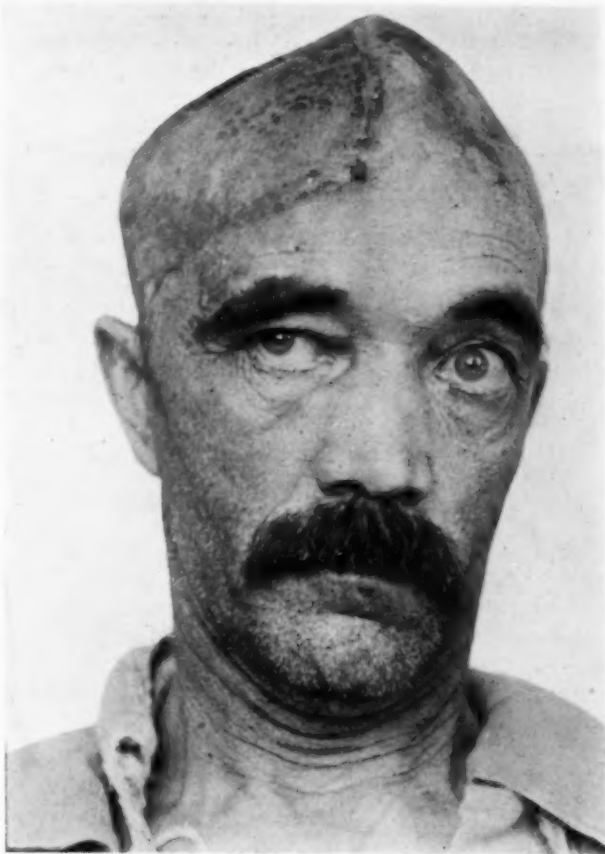


FIG. 4.—Operative scar and defect left by removal of bone flap.

reduction in the size of the tumor. Patient was admitted to Pennsylvania Hospital, November 1, 1924, and November 3 the tumor was excised through a transverse incision following the crease of the neck. The tumor was found to be encapsulated and in close proximity to the vessels—was of reddish-brown color and connected with it by fibrous band was a small gland about a centimetre in diameter. Closely attached to it were some small glands which looked like lymph-glands. A satisfactory clean enucleation was accomplished. Uneventful recovery. The patient was seen less than a week ago. There was no evidence of recurrence nor of metastasis on careful general X-ray examination, and the thyroid seems to be entirely normal.

A pathological examination was made by Dr. John R. Paul, Director of the Ayer Clinical Laboratory of the Pennsylvania Hospital, who reports that on section the substance of the larger mass does not appear as lymphadenoid tissue, but is of a distinctly spongy texture which is dark red in color. One other mass shows a similar texture, but the others appear as normal lymph-glands.

*Histological Examination.*—Sections of these masses show all of them to be of lymph glandular origin with two of them containing infiltrating tumor tissue evidently carcinomatous in type. Primarily the structure of the tumor is essentially alveolar, its resemblance to irregular thyroid tissue being unmistakable, with many typical thyroid alveoli containing pale-staining colloid and again with areas showing inter-alveolar papillary projections of the living epithelium. In other places the tumor loses its alveolar structure and seems to infiltrate neighboring lymphoid tissue in masses similar to an epidermoid type of tumor.

*Diagnosis.*—Carcinoma of (aberrant) thyroid with regional metastasis.

#### ADENOCARCINOMA OF THE NASAL PASSAGES

DR. ASTLEY P. C. ASHHURST reported the history of a man, who came under his care first at the Episcopal Hospital in the autumn of 1922, the patient being then twenty-eight years of age. His history was that four years previously, in October, 1918, he first consulted Dr. Charles C. Biedert, one of the aural and laryngeal surgeons connected with the hospital, on account of obstruction of the right nostril. His weight at this time was 113 pounds, his normal weight being 154 pounds. Doctor Biedert found a soft and mushy growth which bled freely when touched, entirely blocking the right nasal passages; the growth seemed to spring from the septum. Portions of it were removed from time to time, but the growth always returned rapidly. Pathological examination, in December, 1918, by Dr. C. Y. White, showed "inflammatory growth; mucous membrane shows adenomatous proliferation; no tumor formation." Examination of some tissue removed August 10, 1920, showed adenocarcinoma. The man's general condition improved somewhat, however, and he gained weight. In the summer of 1922, the patient was referred to Dr. W. L. Clark, of Philadelphia, for treatment of the growth by electro-dessication. After some months the patient returned to Doctor Biedert with partial destruction of the right ala of the nose, and with the tumor growth unimproved. Doctor Ashhurst was then consulted. At this time (September, 1922) the man looked sick, though his weight was about 140 pounds. Both nostrils were filled with friable grayish granulation tissue, which bled readily when touched. As the nasopharynx was completely blocked by the tumor mass, the condition of the maxillary sinuses was uncertain. The X-ray examination showed an apparently normal sinus on the left, whereas the right antrum was opaque.

## ADENOCARCINOMA OF THE NASAL PASSAGES

The first operation was done September 29, 1922, consisting of ligation of left external carotid; excision of cervical lymph-nodes; excision of right external carotid. Incision 5 cm. long over the left external carotid artery. Enlarged lymph-nodes excised. External carotid ligated at its origin. Second incision on right side of neck, from mastoid downward for 8 cm., slightly convex anteriorly along anterior border of sternomastoid. No lymph-nodes were encountered. The external carotid was identified at its origin and doubly ligated. The superior thyroid, arising between the ligatures, was also doubly ligated. Both the external carotid and the superior thyroid branch were then divided between the ligatures. The carotid was then dissected upward, according to Dawbarn's technic (1903), doubly ligating and dividing in their turn, the lingual, facial, occipital, internal maxillary and common temporal arteries. The trunk of the external carotid was then removed. The operation on the nose was postponed because the patient's pulse rose to 160 at the close of these operations. Considerable time had been lost before beginning the operations, in an attempt to give the ether through an intratracheal tube. It is believed that if this had been successful the entire operation could have been completed at one sitting, as the steps of the actual operations consumed only about 45 minutes. The attempt at intratracheal etherization was abandoned because of profuse and persistent vomiting; the patient later confessed to having contrived to secure his breakfast as usual.

*Second operation, October 7, 1922.* Eight days after the neck operations, the patient was etherized through an intratracheal tube. The anaesthesia was very satisfactory. An incision was made from the inner angle of the right orbit out to the malar bone, and from the starting point both across the bridge of the nose beyond the midline, and down the right side of the nose into the nostril, and dividing the upper lip in the midline. The right cheek was then reflected outward from the face bones, and the anterior wall of the right antrum removed. The antrum was full of polypoid tissue and pus. The median wall of the antrum was then removed, exposing the right nasal cavity which also was filled with the same growth, which seemed to be attached everywhere. The right nasal bone was then excised, the nose cut along its attachment to the septum, and the nose turned across the patient's left cheek after dividing the left nasal bone from the frontal by osteotome. The entire left nasal chamber was now seen, filled with the same growth. The entire bony and cartilaginous septum was then removed down to the hard palate. All the turbinates on both sides were removed, but the left maxillary sinus appeared free from disease and was not opened. The growth filled the entire naso-pharynx, and most of the oro-pharynx, and *handfuls* (literally) of sloughing friable granulation tissue were scooped up from behind the soft palate and below it. The ethmoid cells on both sides were invaded by the growth, as was the sphenoid sinus; all of these were cleared out by gouge and curette, down to bare bone. Then while air was blown into the lungs the entire surfaces from which tumor tissue had been scraped were cauterized



FIG. 5.—Front view of face of patient sixteen months after removal of carcinoma of nares.

with the electric cautery. There was comparatively little bleeding at any time, owing no doubt to the previous neck operations; and it was possible to leave a large dry and clean cavity. This was rather loosely packed with iodoform gauze, which emerged through the right nostril. The soft parts were closed



FIG. 6.—Lateral profile of same patient as in Fig. 5.

with buried interrupted sutures of chromic catgut wherever there was subcutaneous or mucous tissue, and the skin margins with interrupted equisetene. The lines of the incisions were swabbed with Whitehead's paint. The duration of this operation was one hour. The gauze was withdrawn from the right nostril on the second day; and the patient breathed through both nostrils for the first time in more than four years. *Pathological Report* (Dr. C. Y. White): Adenocarcinoma of the nasal passages with metastasis to cervical lymph-nodes. The weight of the tissue removed from the nasal passages was 107 grammes. Eleven days after the operation he was discharged from the ward, and was referred to Doctor Biedert for local treatments, and to Doctor Bromer for röntgentherapy. The X-ray treat-

ments (erythema doses, with  $9\frac{1}{2}$ -inch spark gap) were given February 7, February 21, March 4, and April 4, 1923.

During the year following the operation, the patient's nose gradually collapsed, owing to absence of the septum. A deep dimple developed near the mid-line, while the tip of the nose fell over toward the right cheek. In the side view scarcely any projection of the nose could be seen (Figs. 5 and 6).

After more than a year had elapsed without any evidence of recurrence of the disease, or of metastasis, it was determined to attempt plastic operations on the remains of the nose, in an effort to improve the man's appearance.

A dental splint was secured, through Doctor Schmidt, the resident dentist at the Episcopal Hospital. This was swaged to the patient's upper teeth, and carried two projecting arms which were bent around to fit into the nostrils. The ends of these arms were covered with "dental composition" and, after a minor plastic on the right nostril (January 16, 1924) they were inserted into both nostrils, thus restoring the nose very nearly to its original shape (Fig. 7). On February 16, 1924, the nasal splints were temporarily removed and cleansed; the splint was replaced in the left nostril, being adjusted so as to raise the tip of the nose higher, and so as to draw the columna nearly into proper position. A Thiersch graft was then cut from the thigh by Doctor



FIG. 7.—Nasal splints with dental supports.

removed and cleansed; the splint was replaced in the left nostril, being adjusted so as to raise the tip of the nose higher, and so as to draw the columna nearly into proper position. A Thiersch graft was then cut from the thigh by Doctor



## ADENOCARCINOMA OF THE NASAL PASSAGES

Boykin, sutured (with its raw surface out) over the dental plug on the right arm of the splint, and the latter was then reinserted into the right nostril, thus holding the Thiersch graft against a raw surface on the interior of the nostril. On March 8, 1924, a piece of costal cartilage (3 to 4 mm. thick, 5 cm. long and 1.25 cm. wide) was transplanted into the patient's nose by undermining the skin down to the tip of the nose through a transverse incision 1 cm. long at the root of the nose. It was difficult and tedious work to create this subcutaneous channel without perforating either overlying skin or underlying mucosa, especially owing to the previous operative removal of the right nasal bone and of the entire nasal septum. The nasal plugs attached to the dental splint were reinserted at the close of the operation. Eleven days later (March 19, 1924) the skin sutures were removed, and new nasal plugs inserted, attached to the original denture. Though the operative incision had healed cleanly, a minute slough had occurred in the skin at one point along the right of the cartilage transplant, and a little fluid was discharged from this sinus for several weeks. Healing was eventually complete.

The history of this patient was reported (but not submitted for publication) at the joint meeting of the Academy of Surgery and the New York Surgical Society held in Philadelphia, March 12, 1924. No suggestions for further treatment were received from the numerous surgeons present, though several stated that it would be easier to make an entirely new nose than to continue to patch up the old one. Doctor Ashhurst said that he had realized this from the first, but that the patient preferred to keep his original nose, and was quite willing to go to any amount of trouble and temporary discomfort with this end in view.

It was next determined to attempt to insert a sliver of cartilage in the remains of the *columna*, with the idea that such a support would keep the tip of the nose from collapsing. It was thought possible, if this procedure were successful, that at a later date a piece of cartilage might possibly be implanted in the region of the right *ala nasi*, thus preventing the tip of the nose from turning down toward the patient's right cheek; but as a great part of the anterior surface of the right superior maxilla had been cut away at the original operation, it was uncertain whether any firm lateral support could be found for such a transplant.

May 10, 1924, an incision was made in the midline of the cutaneous surface of the *columna nasi* from the tip of the nose to the upper lip, where a cross-incision was made 0.5 cm. long, exposing the superior maxilla in the midline. The *columna* was cautiously split to admit the cartilage transplant. As the *columna* measured not more than 1.25 cm. from its skin to its mucous borders (owing to the previous operative removal of the entire *septum nasi*), the transplant had to be very small; but when the skin was sutured over it, it proved to be strong enough to hold the tip of the nose up in good position. The intranasal splints were then replaced.

Unfortunately, soon after the intranasal supports were removed, the tip of the nose began to sink down again, being perforated by the cartilage



FIG. 8.—Final result of operation for plastic repair of nose.

transplant in the columna; so that the entire transplant had to be removed as a sequestrum, several weeks after its insertion. However, the deformity did not recur to the same extent as before, the longitudinal cartilage transplant maintaining the bridge of the nose very successfully.

The patient was finally discharged from the hospital in June, 1924, and had no further trouble until October, 1924, when he returned with scabs over the site of the previous slough on the bridge of his nose. When these were removed, the bare cartilage transplant was seen lying at the bottom of the sinus. Under repeated dressings, twice weekly, with balsam of Peru or ichthyol, and with cleansing by peroxide of hydrogen and stimulation with nitrate of silver, the exposed cartilage gradually became covered with granulations and was on the point of being completely epithelialized, when a new opening appeared in the operative scar at the root of the nose; and in a week or so a minute sequestrum of cartilage was removed from this sinus early in December, 1924. Within a week both sinuses in his nose healed, and remain healed at present (March, 1925), when his appearance is much as shown in Fig. 8 taken in June, 1924.

It may be added that recent rhinological examination shows no evidence of recurrence of the carcinoma. The patient visits Doctor Biedert once in two or three weeks to have his large intranasal spaces sprayed out, and continues to breathe in comfort through both nostrils.

DOCTOR ASHHURST also reported a case of carcinoma of a lingual thyroid.

#### REPAIR OF NASAL DEFECT BY ITALIAN METHOD

DR. IRVINE M. BOYKIN presented a man, twenty-eight years of age, who entered the hospital in April, 1924, on account of a deformity of his nose, the result of being struck by a piece of flying metal while at work the previous November. There had resulted a triangular defect of the right ala close to the septum, measuring 8 x 7 x 10 mm.

For the repair of this defect under local anæsthesia a flap of whole skin thickness, 6 x 2½ mm., was outlined on the anterior surface of the right arm, the longest dimension of the rectangular flap being crosswise the arm. The flap was then dissected free for its entire length, the two ends being left attached. The under surface of the flap was then epithelialized by one free graft large enough to cover the entire raw surface; interrupted silk sutures held the graft in place. One week later the flap was cut free from its inner attachment. The color was good, bleeding free, and the skin graft on the under surface had "taken." Four months later, with the forearm at right angles to the arm, a plaster case was applied from the finger tips to the shoulder, a large window being left over the flap. The forearm was then placed across the vertex of the head, thus bringing the flap near enough to the nose to be attached. Under local anæsthesia the edges of the defect in the ala were freshened. The free end of the flap was then trimmed to fit and sutured into the defect by interrupted silk sutures. Another case was now applied which incorporated the head, neck and chest. The case of the arm was then fixed to the head case. At the end of two weeks there was seemingly good union between nose and flap, so the stitches were removed and the flap cut free from the arm, leaving a redundancy attached to the nose. The plaster case was removed.

After six weeks more, without anæsthesia, the redundant portion of the flap was removed by a wedge-shaped incision flush with the margin of the ala. The skin edges were coaptated with interrupted silk sutures.

## SURGICAL EMERGENCIES OF THE ABDOMEN

It will be noticed that quite a long space of time elapsed between certain stages of this operation. This was purposely done for three reasons: First, to permit shrinkage to take place; secondly, to get the greatest amount of vascularization, and thirdly, to clear up any infection that might be present. This allowing of ample time between stages is one of the most important rules of plastic surgery.

The amount of discomfort experienced by the patient, held for so long a time in this awkward position, was surprisingly little. He complained the first day of pain over the occiput, which was immediately relieved by cutting a small window over this area. On removing the case his shoulder was stiff and painful for a short time.

A warning should be given patients of this kind against undue exposure of the nose to cold. The vessels in the graft have no vasomotor control so that when exposed to a low temperature the blood stagnates, freezes and sloughing results.

DR. ROBERT H. IVY said that there is no doubt that the forehead flap is the best source of tissue to restore total and sub-total defects of the nose. It is in the lesser defects where one ala or part of an ala, or part of the tip is missing, that one is in a quandary as to whether the end to be gained justifies subjecting the patient to these extensive and tedious operations. Regarding particularly the Italian method, it would appear that other means can be employed which are much less irksome to the patient and which give more satisfactory end results. For restoring one ala a horizontal forehead flap with pedicle at the temporal region is satisfactory, while for both alæ and tip of the nose the forehead flap with pedicle at the inner canthus of the eye is preferred. The lining for the defect can be made by inverting skin from the edge of the defect or by Thiersch grafting the under surface of the forehead flap, or (in extensive cases) by folding under the distal end of the forehead flap. In one case of restoration of the eyebrow by a pedicled flap from the scalp he had experienced a temporary shedding of the hair. After a few weeks, however, a new thick growth of hair appeared.

## SURGICAL EMERGENCIES OF THE ABDOMEN

DR. ELDRIDGE LYON ELIASON read a paper with the above title, for which see page 917.

DR. GEORGE P. MULLER remarked that notwithstanding increasing experience he found himself unable to accurately diagnose an injury within the abdominal cavity. In gunshot and stab wounds of the abdominal wall he advised operation immediately in all cases. In contusions he operated as soon as the symptoms became suggestive. If the symptoms point toward a kidney lesion, he only operates in the presence of a hematoma, evidence of severe bleeding, or persistent bleeding through the ureter.

DR. LEON HERMAN said that several years ago a railroad brakeman was admitted to the surgical service of Dr. George Ross in the Methodist Hospital with symptoms of severe visceral injury. He had been crushed between two freight cars and died of shock almost immediately after admission. It was found on post-mortem examination that the jejunum was ruptured in two

places and that he had a horse-shoe kidney, the isthmus of which was torn completely across. In reporting this case he remarked that with the exception of one described by Henry Morris, this was the only instance of the kind he knew of having been recorded. Dr. A. J. Scholl, of Los Angeles, and Dr. Daniel Eisendrath, of Chicago, have since each written to him calling attention to the fact that Hinterstoisser (*Wien. klin. Woch.*, 1920, No. 33, pp. 942-943), has reported a third case. In this instance, a wagon wheel passed over the abdomen; the patient died of hemorrhage. In Morris' case the injury resulted from the kick of a horse in the abdomen. Doctor Scholl also called attention to a fourth case reported by Biggs (*Med. Record*, 1892, vol. vii, p. 518) in which a truck wheel passed over the abdomen, fracturing the spine and lacerating the isthmus of a horse-shoe kidney.

## CORRESPONDENCE

### PATENT URACHUS

EDITOR ANNALS OF SURGERY:

Sir:

The diagnosis of patent urachus is simple. The presence of urine at the umbilicus establishes the presence of the anomaly. Moreover, the presence of a persistent purulent umbilical discharge suggests nonclosure of the allantoic remains, and the passage of a sterile probe, or a filiform, discloses a canal from which urine may be made to flow. Urine may pass drop by drop more or less constantly, or what is more usual, a small stream will flow at each act of micturition, as in the case we are reporting. In our case the mother noticed the urinary discharge first when the cord dressing came away on the sixth day.



FIG. 1.—Urachocystogram, lateral view.

Throughout the two and a half years of its life there had been no cessation of the urination through the umbilicus. The diagnosis should not be considered complete without canvassing every possibility of obstruction. In children, vesical stone, congenital urethral stricture, phimosis; in adults, stone, stricture, prostatic hypertrophy, etc., should be carefully looked for. In the case now reported Doctor Willis, röntgenologist, and Doctor Grant, urologist, at my suggestion collaborated to make a urachocystogram. An opaque ureteral catheter was passed into the navel end of the fistula and the usual pyelographic medium (14 per cent. solution of sodium



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iodid) injected and Röntgen pictures made (see Fig. 1). The lateral view was of great value in deciding beforehand the nature of the surgical treatment.

*Treatment.*—If the patient is seen in the first year of life it is best to wait, first because of the possibility of spontaneous closure, and second because of the fact that surgical procedures are better withstood after the first year. Two methods are applicable: (1) The urachus may be ligated off at its upper extremity; (2) the urachus may be completely excised and the bladder end carefully closed in with drainage. In either case all of the work may be



FIG. 2.—Operative result of operation for closure of patent urachus.

done extraperitoneally. Lower remarks that operation upon this embryonic remnant is not without danger to life; this holds especially true in infancy and childhood. I believe that in these early cases an attempt should be made to cure the fistula by dissecting out the urachus and careful extra-peritoneal ligation. In the adult, or in older children where the first method has failed, it is best to do the more radical procedure. Mayo states that even here leakage may persist for some time after operation. The latter dissects out the tube thoroughly, excepting a half inch at the bladder end. The duct is ligated and cut off, the stump being then inverted by one or more purse-string sutures, and a drain left. As

has been suggested, it is very essential to examine for sources of obstruction and to remove them where possible. Spontaneous closure has in several reported instances resulted from this alone.

Our patient was a female child of normal appearance and of healthy parentage, age two years and six months, she was seen in consultation with Dr. F. W. Willis. The history and findings of importance were limited to the following facts: The mother noticed urine exuding from the umbilicus at the time the cord dropped. This has persisted up to the present time. At examination, the umbilicus and surrounding tissues appeared perfectly normal except the moisture and the urinous odor. There was no ulceration, no tumor, no purulent discharge, no urine on pressure. The mother stated that the urine came usually at the act of urination. This was observed. A small catheter was passed without difficulty into the bladder *per urethram*. The urine was clear and the urinalysis disclosed no abnormal constituents. The urachocystograms, especially the

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lateral view, depicted well the condition. A study of this determined the operative procedure. In view of the large funnel-shaped character of the tube at the bladder end, it seemed advisable only to ligate the umbilical neck. On August 6, 1924, under ethylene anaesthesia an incision was made in the median line beginning 0.75 cm. below the umbilicus and extending downward for 6 cm. Both rectus sheaths were opened into and the urachus was exposed. The tube was readily felt as a rounded cord slightly less than a centimetre in diameter. Great care was exercised to avoid rupturing the peritoneum. A ligature of No. 1 chromicized catgut was passed around the urachal cord at its highest exposed portion and securely tied. A second ligature of linen was placed 0.5 cm. below this. The rectus edges were sutured with No. 0 plain catgut interrupted. The sheaths were closed with No. 1 chromicized, and the skin closed as usual with interrupted silkworm gut. A rubber tissue drain was placed down to the subrectus space and brought out at the inferior angle of the wound. Convalescence was uneventful except that on the second or third days the urine was blood tinged. Up to the fourth day a slightly urinous odor was detected on the dressings. The skin sutures were removed on the seventh day. On the ninth day the patient left the hospital the wound entirely healed. When examined August 20 the wound was entirely dry. The photograph (Fig. 2) was made on that day.

Some authors have recommended opening the urachal tract and cauterizing. This does not appear to me to be good surgery, although some successful results have been reported by its use.

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### CHRONIC POST-CÆCAL SUPPURATIVE APPENDICITIS CAUSING LUMBAR ABSCESS

EDITOR ANNALS OF SURGERY:

Sir:

In the typical text-book picture case of appendicitis, the diagnosis is not at all difficult; indeed it is so simple that in some instances the patient makes the diagnosis himself before consulting a physician. On the other hand, the atypical cases demand prolonged study and even then the diagnosis is not at all clear. It is with the desire of increasing the knowledge of these masked cases of appendicitis that the following case history and post-mortem record are presented:

The patient, J. N. K., was first admitted to the Albany Hospital on June 7, 1923, for relief of a painful stiff back. He was a male, aged fifty-nine, married with two children. His previous history except for trouble with the back was entirely negative. This was gone over repeatedly without bringing to light any significant details.

For several years he has had a bad back causing pain and fatigue. In 1922, he had X-rays taken of the spine and these showed some roughening of the lower dorsal and lumbar vertebrae. About three months ago, the pain in the back became worse and since then has persisted day and night with varying intensity. The pain has been and is so bad that it makes standing any length of time impossible. At times the pain radiates down the right leg. A few days ago the pain became worse in the right lumbar region and an inflamed area appeared in this locality. This new development caused him so much pain that he was forced to take to his bed and resulted in his seeking medical advice.

Upon admission to the hospital the patient's temperature was 99, the pulse rate 80, respirations 18, blood pressure 110-80. He was a short wiry individual who walked with a limp and held his right thigh partly flexed. Examination of the head, neck, chest,

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upper extremities and abdomen was negative. Low down on the right side of the spine was a red fluctuating mass. The right thigh was partly flexed on the abdomen and attempts at extension caused the patient to complain of pain in the back. There was marked limitation of motion of the lower dorsal and lumbar vertebræ.

Urinary examination at this time showed nothing abnormal except high specific gravity. X-ray examination of the spine on the day after admission was made with the following report: "Ring-like formation of bone along the spine on the right side. Shadows of the kidneys apparently normal. At the junction of the 5th lumbar vertebra and the sacrum on the right side, the bones seem somewhat crushed together, suggesting the possibility of a destructive process at that point. Below the right iliac crest about two and one-half inches from the spine there is a circular shadow suggesting an enterolith."

In view of the X-ray findings suggestive of caries of the vertebræ, the presence of an abscess in the lumbar region, and existence of spasm of the psoas group of muscles causing flexion of the thigh, it was felt that we were probably dealing with a tuberculosis of the spine. It was therefore decided to open the abscess which presented evidence of secondary infection.

This was done on June 8 and at operation a probe was inserted deep down into the wound to determine the origin of the abscess if possible. No erosion of bone could be demonstrated but the probe appeared to pass well anterior to the spine level before resistance was encountered. Smears from the abscess of the back taken at the time of operation showed a few Gram-positive bacilli but no tubercle bacilli. Cultures taken at the same time yielded insufficient growth for diagnosis. However, the pus had a very definite colon-like odor.

Following operation the abscess of the back continued to drain freely. However, we were not at all satisfied that the problem was one of vertebral disease and so on June 22 further X-rays were taken. One of us (E. A. V. V.) recalled having seen a more or less similar case due to an appendicular abscess burrowing posteriorly from behind the cæcum. This diagnosis, however, was passed over with the receipt of the following X-ray report. "Two calculi, one about one by one and a half cm. in diameter, the other two by two and a half cm. in diameter which lie anterior to the crest of the right ileum and position considerably anterior to the usual course of the ureter. The larger of these two shadows has a distinct ring-like formation suggesting the possibility of its being gall-stone in origin. The shadow of the right kidney can be made out distinctly, apparently normal in size, shape and position. Pictures of the gastro-intestinal tract otherwise negative."

In order to rule out the right kidney ureteral catheters were passed June 25 and further pictures taken. This procedure gave us the following information. "Ureteral catheters show that the ureter is in normal position and bears no relation whatsoever to the two calculi; the calculi lying in a position considerably external to that occupied by the ureter. Sinus tract can not be made out (an attempt had been made to fill this with bismuth paste)."

It was realized that this patient's kidneys were not functioning well and June 28 the urine showed hyaline casts and cylindroids with a two hour phenol test of 15 per cent. Under the indicated treatment, the kidney condition improved somewhat so that the urine was free of casts and cylindroids on July 2. However, the phenol output did not rise much. The sinus in the back still continued to drain and as it was felt that very little more could be done to the patient until his general condition improved, he was allowed to go home on July 10. During the stay in the hospital the temperature had ranged from 99 to 100.6 and the pulse from 80 to 100.

Following his departure from the hospital, the patient was sent to the country for building up and was seen at intervals. During this time the wound in the back drained intermittently and he continued to lose strength and weight.

On October 4, he was readmitted to the hospital for five days to be carefully looked over. During this stay in the hospital, his temperature fluctuated from 99.2 to 101.4 and

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the pulse from 110 to 126. Routine 24-hour examination of the urine was negative and phenol function was 25 per cent. in two hours.

On October 29, he again entered the hospital; this time for exploration of the abdomen, as it was seen that he was not improving any under present conditions. Upon admission urine examination was satisfactory and phenol 20 per cent. In spite of this low phenol it was decided to operate as we felt that further procrastination would be fatal.

On October 30, under novocaine and light ether anaesthesia, exploration of the abdomen was attempted. The gall-bladder was found filled with a large stone and the right lower quadrant occupied by a large inflammatory mass which was closely adherent to the posterior abdominal wall. Further investigation or operation was prevented by the sudden collapse of the patient. The wound was hastily closed and the patient returned to his room where he rapidly recovered from the shock of operation.

The operative wound healed quickly but the sinus in the back continued to drain. The temperature range was from 99 to 102.4 and the pulse from 80 to 136. As there was little else to be done for the patient he was allowed to go to his home on November 20, 1923.

At home simple supportive treatment was carried out but in spite of everything he continued to lose strength until his death on February 2, 1924.

Post-mortem examination limited to the abdomen was performed on the date of death, February 2, 1924. Following is the report of this examination:

The body is that of an emaciated, white male adult. There is marked pallor of the skin and mucous membranes. No superficial glandular enlargement noted. The skin in the right lumbar region is bluish and moist. An old healed incision is present at this point, and about it are several small perforations, through which exudes purulent material. The lower extremities are oedematous.

Peritoneal cavity. The surfaces appear normal. The appendix is 10 cm. long and surrounded by firm fibrous adhesions. The tip of the appendix is very adherent to the soft tissues posterior to the cæcum and when removed, a small pocket containing a fecalith is found. From this pocket extending to the posterior abdominal wall are several sinuses. There are a few old adhesions about the gall-bladder which appears to be enlarged and thickened. On opening the gall-bladder, a single gall stone about 3 cm. in diameter is found. The gall-bladder is partly filled with thickened bile.

The kidneys are small and red, the surface granular; the cortices thin and containing small simple cysts.

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## BOOK REVIEW

ORTHOPÆDIC SURGERY OF INJURIES. By various authors. Edited by SIR ROBERT JONES, F.R.C.S. London: Henry Frowd, Oxford University, Press. Hodder and Stoughton, 1921, 2 vols., large octavo.

We took up these books with great enthusiasm, expecting to find a treatise on Orthopædic Surgery that would be complete and of intense interest, reflecting the experience and the judgment which one would expect from the reputation of the Editor. In the first place, it is not an Orthopædic Surgery, nor on the other hand, is it a satisfactory text-book of Military Surgery. It seems to us that the term Orthopædic is being used very loosely. It should be retained in its original application or another name should be found to cover the new fields now being invaded by the orthopædist. According to its derivation the word means a straight child, or according to Foster, "The prevention or correction of deformities, especially in children." With the advent of the operating orthopædist the scope of the specialty was greatly widened, but still the definition was accurate. How the name can be applied to many of the essays in these two volumes it is hard to conceive. In the second place, it can not be accurately called Military Surgery. It seems to us it would have been much better to call it a treatise on Traumatic Surgery, for after all that is the subject dealt with in most of the Essays. Most of these articles were written and published in journals during or just after the war; some of them apparently have not even been revised by the authors, though we know that some of the views expressed in the first volume were modified by later experience.

We turn to the second volume with a sigh of relief, though here, too, we find in the last essay, "The Organization and Administration of a Military Orthopædic Hospital." Most of this volume is devoted to the treatment of injuries of the brain, spinal cord, and nerves. All of this work is well done, and the conclusions are conservative and plain. This volume makes up for the short comings of the first volume, and should be in the hands of every man who may be called upon to operate on cases of this class.

SAMUEL LLOYD.

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